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THE AMERICAN GAS LIGHT JOURNAL

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

November Meeting, Society of Gas Lighting.

OFFICE OF THE SECRETARY, Nov. 4, 1898.

The November meeting of the Society of Gas Lighting will be held in "The Arena," No. 39 West 31st street, New York city, at 3 P.M. of the 10th inst.

FRED. S. BENSON, Secretary.

[OFFICIAL NOTICE.]

November Meeting, Guild of Gas Managers.

OFFICE OF THE SECRETARY, Nov. 3, 1898.

The November meeting of the Guild of Gas Managers will be held in Young's Hotel, Boston, Mass., at midday, the 12th inst.

A. K. QUINN, Secretary.

BRIEFLY TOLD.

MR. DOHERTY'S PAPER.—Academicians are supposed to have made their mark on the scroll of fame, prior to their enrollment on the lists which are the support of the academies, and the further belief on the part of those who have to carry on polemical work, is that the crown of the academy, lacking thorns, is conducive to lethargy. So it comes that the polemic welcomes always the appearance of one who, in contesting for future lethargy, has with him the briskness of truth and the speed of energy. The Niagara meeting of the American Gas Light Association seems to have developed a polemic hotspur, in the person of Mr. Henry L. Doherty, of Madison, Wis., whose paper, to the question of "How Can We Make the Use of Gas More Universal?" evoked the best and most practical discussion of the sessions. Perhaps the title of his paper least shows its merits, for indeed would he be a superlative man who could ring the degrees on "universal," but apart from that, the paper is the catholic history of a simple, continued effort to put gas into places, and on different use account, in the city in which the author served his Company. If a paper may be judged as to merit, through the discussion which it elicited, then it must be said that Mr. Doherty wrote to much purpose when he prepared his paragraphs for the Niagara meeting. His subject was neither wise nor high, but it was applicable and level to the business of every gas company in the country, and in such understanding each superintendent may take from it, and from its discussion, much that will benefit himself and advantage his company.

DEATH OF MRS. J. L. HALLETT.—Another of the fraternity has been stricken sorely by death, whose harsh decree this time removed from life Mrs. Mary L. Hallett, the estimable wife of Mr. Joseph L. Hallett, for the golden period of his career in the gas business the respected Manager of the Springfield (Mass.) Gas Company. Mrs. Hallett (who was a daughter of Mr. John Archer, of the firm of Archer & Pancoast, in their day well known to every gas man in America), died in this city, the morning of October 29th, after an illness that lasted many months. The funeral services were held the afternoon of October 31st, at her husband's home, 543 West 141st street, New York. Her survivors are Mr. Hallett and their two sons. Interment was made at Hyannis, Mass.

THE EDUCATIONAL FUND SUBSCRIPTION.—We repeat the list of subscriptions (to the educational fund of the American Gas Light Association) as that list appeared last week. We regret to say that no additions have been made to it; we are glad to say that the starting sum named by its founders has been reached, and we will be pleased to note any further subscription amounts that come to hand. The completed list is:

Subscriber.	Total Amount Pledged.	Amount per Year Through 5-Year Period.
Akron (O.) Gas Light Company	$75	$15
American Gas Company, Phila., Pa	1,000	200
American Gas Light Association	...	250
American Gas Light Journal	125	25
American Meter Company, New York	250	50
Auburn (N. Y.) Gas Light Company	50	10
Austin (Tex.) Gas Light and Coal Company	50	10
Barber, Chas. W	10	2
Beal, Wm. R., New York	300	60
Binghamton (N. Y.) Gas Works	50	10
Blodget, C. W., Brooklyn, N. Y.	50	10
Buffalo City (N. Y.) Gas Company " " Gas Light Company " " Mutual Gas Light Co.	500	100
Clarke, Geo. S., Kansas City, Mo	50	10
Clark, Walton, Phila., Pa	600	120
Cleveland (O.) Gas Light and Coke Company	500	100
Collins, C. R., Seattle, Wash	10	2
Columbus (O.) Gas Company	125	25
Connelly Iron Sponge and Governor Co., N.Y.	50	10
Consolidated Gas Company, of New Jersey	100	20
Crisfield, J. A. P., Savannah, Ga	10	2
Curley, Thomas, Wilmington, Del	5	1
Daniels, Jno. M	25	5
Derby (Conn.) Gas Light Company	100	20
Detroit (Mich.) City Gas Company	200	40
Dunbar, J. W., New Albany, Ind	50	10
Equitable Gas and Electric Co., Utica, N. Y.	10	2
Grand Rapids (Mich.) Gas Light Company	125	25
Griffin, Jno. J. & Co., Phila., Pa	250	50
Helme & McIlhenny, Phila., Pa	250	50
Humphreys & Glasgow, New York and London	1,000	200
Jackson (Mich.) Gas Company	100	20
Keppelman, J. H., Reading, Pa	25	5
Knapp, Geo. O., Chicago, Ills	500	100
Laclede Gas Light Company, St. Louis, Mo	250	50
Lawrence, W. F., Trenton, N. J	25	5
Love, Dr. E. G., New York	50	10
Madison (Wis.) Gas and Electric Company	125	25
Maryland Meter & Mfg. Co., Baltimore	250	50
McDonald, D. & Co., Albany, N. Y	250	50
Miller, A. S., New York	125	25
Milwaukee (Wis.) Gas Company	250	50
Nettleton, C. H., Derby, Conn	125	25
New Amsterdam Gas Company, New York	250	50
Norwich (Conn.) Gas Light Company	125	25
Old, G	25	5
Peoples Gas Light and Coke Company, Chicago	500	100
Roots, P. H. & F. M. Co., Connersville, Ind	125	25
San Francisco (Cal.) Gas and Electric Company	750	150
Searle, R. M., Atlanta, Ga	25	5
Sherman, F. C., New Haven, Conn	100	20
St. Joseph (Mo.) Gas Company	75	15
St. Paul (Minn.) Gas Light Company	125	25
Tufts, Nathaniel, Meter Company, Boston	250	50
Turner, Thomas, Charleston, S. C	20	4
United Gas Improvement Company, Phila., Pa.	5,000	1,000
Vanderpool, Eugene, Newark, N. J	500	100
White, W. H., New York	125	25
Total	$.....	$3,448

NOTES.—The 50th annual meeting of the Consumers Gas Company, of Toronto, Canada, was held the last day of October. The session was quite in the nature of a love feast, as it well should have been, from the facts and figures presented over the growth of the Company, which records we hope to give next week.——Deputy Sheriff Radley seems to be paying attention to the local properties of the Sunlight Incandescent Gas Lamp Company. The Company, it appears, owes Mr. W. C. G. Wilson something like $4,000 on rent account.

[ABSTRACT OF PROCEEDINGS.—Continued from page 636.]

TWENTY-SIXTH ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

HELD IN THE INTERNATIONAL HOTEL, NIAGARA FALLS, N.Y., OCTOBER 19, 20 AND 21, 1898.

FIRST DAY, AFTERNOON SESSION.

Discussion on Mr. Doherty's Paper.[1]

The President invited Mr. R. M. Searle to start the discussion.

Mr. Searle remarked that Mr. Doherty started his theme by asserting his belief that gas is not generally used for cooking because of a "Lack of appreciation on the part of the public of the general merits of gas" in such connection, which means, of course, that such lack of appreciation is chargeable to their ignorance. In that view the benefit of canvassers and canvassing is apparent. The "General belief that it is more expensive than it really is" is also due to ignorance; wherefore the field of the canvasser broadens. As to "Procrastination." In our Southern country people carry procrastination in their hip pockets; so we will let that pass. "The cost of making installations" seems dependent upon locality and the way you treat your customers. The best record ever made in this country was made by one of the large gas companies, which provided free installation. As to "The use of incomplete or unsatisfactory gas stoves," Mr. Searle thought most of the gas stoves on the market answered the conditions. The place for an incomplete gas stove is on the scrap heap. The sale of such a stove to a consumer was an injustice that could best be remedied by giving him a good one without charge. Gas stoves of to-day become unsatisfactory only through misuse or through the ignorance or recklessness of the user. A serious thing in that respect in his city (Atlanta, Ga.) was the failure of the servants to keep the stoves clean. They had 4,000 out, and a force of 6 men was required to keep the stoves in good working condition, which meant quite a charge in figuring the installation account. He thought it was the duty of the Company to maintain the stoves in repair, for it would be very poor policy to cast aside a $25 stove after a year or two of use simply because it needed fixing up. "Fear of the gas stove" should be an objection easily done away with, perhaps best by schooling and demonstration. He believed firmly in the good results that would follow the practice of teaching cooking in the public schools, and he thought that although the new woman was inclined to favor womens' clubs and all that, he nevertheless believed she would on the average be unsatisfied to unsex herself to the point that she retained no interest in how her home kitchen was conducted. He admitted that the problem of how to furnish a satisfactory or fairly continuous supply of hot water by the aid of a gas appliance, the item of economy being given due weight, was a serious one and far from being solved. Regarding "Dislike to abandon the use of a good coal, wood or gasoline stove," may be effectually overcome by giving to the user a good gas stove. We are in the same predicament over heating stoves that we are in the instance of hot water heaters. As to Mr. Doherty's verdict, "I have never yet seen a free installation which would work to our advantage," let me say I know of results obtained from such placing of 30,000 stoves, and the Companies thus reporting are all paying good dividends. Mr. Doherty so thoroughly answers his questions that it is difficult to speak other than in praise of the paper *per se*, which praise is doubly accentuated by the belief that it is certain to provoke a lively discussion.

Mr. Paul Doty (Grand Rapids, Mich.) then read the following contribution to the discussion: The question is one of methods, of ways and means; and, as usual with these questions, the results of individual experiences are of value to the Association as a whole. The subject admits of discussion, using the word in the sense of debate, from the nature of the question, "How can we make the use of gas for cooking more universal?" for it is believed there are nearly as many methods as men, and individuality is brought forward prominently, for persuasion is an important factor of success. If there be a lack of appreciation of the real merits of gas for cooking let us persuade those who are in error by education. Right here I feel I would take the position that a housewife who is not sufficiently alive to the real merits of gas for cooking, and in a position to use gas, is not worth the educating; but this is extreme. Progress with some is slow, and progress is only possible when work is unfinished. If there were no further field for effort, what would become of our comparative statements, with the increase column always in sight and waiting to be filled, the ever-

1. For text of paper, see JOURNAL, *ante*, 634.

present spur of management? Education by advertising, and by demonstration lectures, is good, but I believe a more powerful means for ultimate success is found in the public school kitchen. Where gas for fuel is used in demonstration the girls have an object lesson where convenience, cleanliness, comfort and economy are in evidence. It is to our interest to encourage this school kitchen work; likewise the private schools or classes of household economics, domestic economy, cooking clubs, or whatever name these associations of ladies may take, should be encouraged by our interest. Our future lies in the housewife who studies the subject, and we want the idea to get abroad that gas for fuel is up-to-date and that everybody who is anybody uses gas for fuel. Further than this, I have placed a range in an intelligence office, and, under arrangement with the proprietress, the servant girls while waiting for employment are instructed in gas cooking. We also gave them "Marion Harlan's 'Cooking by Gas'" to read, and we find the plan works well. The time is fast approaching we think when the living-out girls will not take a place in a kitchen where gas is not used for fuel. These cook books are signs of the times, for while the former directions were "To sit on the stove and stir constantly," now it is "To sit on the gas stove and stir constantly;" anyhow, gas has stirred things up and we are the gainers. It is undoubtedly true there are mistaken notions of the expense attached to the use of gas for cooking. Gas in the hands of careless servants runs into money fast; in the hands of the careful housewife the bills are cut in two. If the mistress could arrange an allowance system, so much for gas, and you must do the work or go back to coal, I imagine many a servant would practice economy. Here we can encourage the mistress by instructing her in the mysteries of reading the meter, and if she will take daily readings I guarantee the bills will come down. Mrs. Rorer says: "Gas must be mixed with brains." "Procrastination is the thief of time;" but even here gas helps, for gas saves time. We should persuade procrastination when thieving to "Take time by the forelock." I advocate free services and fuel connections. I do not advocate free ranges. I believe the gas range gives value received, and ultimately is most appreciated where obtained by purchase. Last spring we had a motto competition in our city, and offered prizes for the most suitable motto to be used in advertising gas ranges. The first prize was $5, and the interest was general. The motto which won the award, "Measure for Measure—A Gas Stove for Your Money," best expresses my position on this point. We sell ranges above cost, the average price being 25 per cent. above cost. We deliver and connect ranges free, whether purchased at our salesroom or at the local stove stores. We encourage the local dealers to handle gas stoves by paying $4 commission for each four-hole range sold; other stoves proportionately. They sell at the prices fixed by us and make the commercial profit. The commissions we pay to them they spend in whole or in part in advertising. The arrangement is mutually satisfactory. We employ five solicitors, each in allotted territory, and pay them a commission of $5 for each range sold. We have an extensive appliance department for the sale of fixtures, Welsbach lights—both for inside and outside lighting—Backus heaters and gas appliances generally; and on all these the solicitors receive commissions on orders. By these means the solicitors make a good living all the year. As a result of this method of handling ranges I would state the outside dealers sold this year to date 170 ranges, the solicitors sold 215, and we sold from our office 250—a total of 635 ranges. In addition 321 two and three-burner hot plates were sold, or a total of 956 gas appliances for cooking installed this season; an encouraging result I think, and one which is giving satisfactory returns in gas sales, the increase for the past three months being 14 per cent. The appliance decartment will show no profit, but will pay operating expenses, which include advertising, rent, light and heat, and the salaries of three permanent employees, one of whom is a young lady who investigates complaints, follows up new users of gas, gives instruction in the economical management of the range, and gives demonstrations during the summer season at our office, on the 14th and 15th of the month, these being the heavy discount days. At these times we serve luncheon, from noon till 5 o'clock in the afternoon, giving the ladies who call palatable as well as ocular proof of the pleasures of gas cooking. We have served as many as 350 ladies during one of these afternoon luncheons, and that they are popular goes without saying.

Gas stoves to-day are generally satisfactory and economical in operation, and show many improvements during the past few years. A sign of the times is the getting together of the manufacturers for mutual interest. The expressed desire for uniformity in stoves, in other words, the standardizing of the stove, would seem to indicate the manufacturers regard further improvement limited. I take exception to the wisdom of discouraging the adoption of the hot plate. If for no other reason than a means to an end its use should be encouraged. The hot plate is the engagement ring, the promise of the day when the wedding of the housewife and the range will come. The use of the portable oven with the hot plate should be encouraged, for with these two excellent and satisfactory cooking can be done. Broiling can be done by the method known as pan broiling, a good deal better way of cooking meats than frying so common in practice. Hot water heating is important, but we have not found a satisfactory water heater, but with the many minds at work on the subject success will come. The combination heater and thermostat is a step in the right direction. The garbage question has some bearing on the subject, but the disposal is a question of ways and means. With coal or wood there are the ashes, dirt and dust, the disposal of which is much more troublesome. But little kitchen refuse is combustible; no matter what fuel is used, the cans, bottles and other junk must be carried away, and in the cities the strictly so-called vegetable and animal garbage is carried away by the city department. The heating of the kitchen in homes already built without provision for other heat than from the kitchen range certainly retards all the year use of gas for cooking; but modern construction recognizes the utility of gas by making provision for heating by furnace or stove heat; and many apartment houses in the large cities have no other than the gas range, an encouraging sign from the owners and architects who are up-to date.

Gas companies to-day must advertise. Advertising in the abstract is a tax on business, a premium against competition; but as business is conducted by successful merchants, so we, having a merchantable article, must conduct our business. Successful merchants advertise and we get in with the procession. How to advertise successfully, how to build business, is a problem, the subject of books.

Gas men, technical men, have not always the talent of expression, have not the pen of a ready writer, and are thus handicapped in the struggle. I have thought much energy could be saved by having a central advertising bureau for the supply of suitable matter for printers' ink, where all would have the advantage of trained minds in the campaign of education. This suggestion was made several years ago to one of the gas journals. This year we have contracted with an advertising bureau in New York for cuts and descriptive matter to be furnished weekly, and I think the results satisfactory. In computing the value of newspaper advertising we must remember the circulation is both urban and suburban, the latter often exceeding half the total issue. Street car advertising I have tried successfully this summer, and will probably use this means next summer. But, after all, it is the personal solicitation, the getting together of the individuals, the persuasive power of the company's salesman, himself convinced of the merit of the selling value of his product, which brings this product into the home and kitchen. Gas for cooking is all right, and it is here to stay and grow.

Mr. H. H. White, of Portsmouth, Va., said that seven of the largest churches in that city are heated exclusively by gas. They are using the Wolfe gas radiator. He had been very successful in extending the use of gas for heating, but regretted to say he was not so successful with cooking stoves, only 60 such having been placed, and they had only been placed after personal solicitation in every case. Considering that they had only been working up the fuel business for a comparatively short while, the results were encouraging. A statement of the consumption of gas by the different churches showed that one church saved $140 per year by the use of gas as against the cost formerly charged to heating account. The church is 65 feet long and 40 feet wide, and will seat about 400 people. Before we put in the gas radiator apparatus (the installation cost them about $125) they paid the sexton $240 per year, and their fuel bill was $60. The sexton's salary, after gas was used to do the heating, was reduced to $120 per year, and their gas bill for three years had never exceeded $42. A special meter was used, and the gas rate was $1.25 per 1,000. In another instance we put in 22 No. 10 Wolfe radiators, and these for two or three years have consumed from $40 to $60 worth of gas per annum. We make it a point to thoroughly clean, repair and if necessary rebronze the radiators at our own expense. Aluminum bronze does not wear any better than does nickel plate.

Mr. Littlehales said he was much interested in the paper read by Mr. Doherty, which was right in line with his own experience. He was especially glad to hear the reference to the desirability of separate meters for fuel gas at different prices. The speaker's contention, and firm belief as well, was that a special meter should be used on fuel account, no matter whether like prices were paid for a fuel or illuminating use. This system was a safe one to follow. As an instance of this Mr. Littlehales cited an experience in his own home. About 10 o'clock one

evening Mrs. Littlehales visited the kitchen, on opening the door to which she was almost overcome by heat. The gas range was in full operation, and had been from the time the servant started it about 5 P.M., she also having neglected to turn it off when she retired for the night, meanwhile having permitted the gas to burn between the time of cooking the supper and going to bed. That case might be applied in the instance of an ordinary consumer, and it would be easier to convince the latter that neglect had occurred were his gas measured through two meters instead of one. In his experience, having had to do with many methods for extending the use of gas, he believed the canvasser was the one who yielded the best results. Of course he presumed his hearers would give due weight to the fact that the canvasser must be of the right sort. In Syracuse, N. Y., they had, in something over two years, placed upwards of 2,000 ranges, which consumed on the average 16,600 cubic feet per annum.

Mr. Graves (Rochester, N.Y.) said he thought there was something to be charged against superintendents themselves in the matter of advancing the use of gas ranges. While they talked all the time about the advantages of ranges, it was nevertheless true that many of them failed to use the ranges in their own homes for the 365 days of the year. Now, how could one expect to have many converts unless one practiced what he preached? In fact, the superintendent who talked gas fuel but failed to use it was very much like the patent medicine vendor who, when asked whether his family took the medicine that he advocated, replied, "No; he only manufactured it." He thought every superintendent should have his home kitchen fitted up in the handsomest manner possible, without a vestige of any other cooking apparatus in it than a gas range. Then he could invite any of his townsmen to inspect "how it was done at home." He also firmly believed in personal canvassing, putting such work in charge of a special man, rather than in the hands of the man behind the desk; for the latter might often neglect to pay proper attention to a prospective fuel gas user, because of his anxiety to get through with some special or pressing bit of work on his books. The coal stove men do not entirely trust the sale of stoves to their bookkeepers. I know something about the stove business, and let me repeat that I know that a good salesman is well worth the salary paid to him. Another thing worth remembering is that the gasoline or vapor stove man is a sort of pioneer for gas ranges, but the coal range man is your real competitor.

Mr. Jenkins thought if they paid too much attention to their home kitchens, with the end that one's townsmen might appreciate their beauties, they would be swamped by visitors who might stay so long that the Superintendent's salary might not be more than enough to entertain them. Of course he believed every Superintendent should use gas for cooking continuously in his home, but he believed, too, that one of the most important things in introducing gas stoves was in insisting that they should be set by the Company's men. In Buffalo they will not sell, lease or set a stove unless authorized to install them.

Mr. Pinkney asserted his firm belief in the principle of having cooking classes in the public schools, for in Utica they had practical illustration of the benefit of such instruction. Four years ago the superintendent of instruction in Utica informed him that he proposed to teach cooking in the schools, and asked an opinion as to the availability and economy of using gas as fuel for the purpose indicated. Of course, he had only one reply to make. He also said the Company would gladly supply and put up 20 hot plates and a large oven for use in the schools. They did so, and eventually received from the Board of Education a vote of thanks. In due time he had a practical example of what was being accomplished, for his 14-year old daughter who attended public school, one evening pronounced her opinion most positively in favor of gas fuel for cooking, and later on tried her hand at cooking a meal on the kitchen gas range. He agreed, though, in Mr. Jenkin's suggestion that, were our home kitchens fixed up as favored by Mr. Graves, our salaries might not be up to maintaining them.

The President suggested that a word or two from Mr. E. G. Pratt, of Des Moines, Iowa, on the subject under discussion would be acceptable.

Mr. Pratt thought the subject had been so thoroughly covered that little was left that could be said which would be of interest. One proposition by Mr. Doherty which appealed to him forcibly was "The general belief that it was more expensive than it really is." It is the idea which we must eradicate from the minds of our actual and prospective consumers. It is in fact the main objection with which we have to contend. My belief is too that there is practically no limit to the field of the use of gas for cooking. Although we have done good work therein in our city, we realize more and more that, instead of the limit having been reached, opportunities become greater as our methods advance. I hold the opinion now it is not the man of means who can use a gas stove to the best advantage. The man with an income of $50 or $60 a month is the one who can best afford to use a gas stove, for in his case his wife does all the cooking, and thus it is not left to a servant, wherefore the results are not only better but there is greater heed paid to economy. No complaints come from that class of people. The prepayment meter is of great advantage in connection with the use of gas stoves, for it can be made to take the place of the gasoline card often hung in the window, for the consumer can see exactly how much gas he is getting for the quarter that he placed in the slot. Then again the account does not seem as large as when a lump bill is presented at the end of the month. Mr. Jenkins's point regarding the installation of gas stoves was a most important one. In Des Moines we see to the placing of every stove, and follow that placing by a visit from a woman instructor (an expert in cooking), who teaches the user how to operate the apparatus with skill and economy. Mr. Doherty's seventh proposition, "Dislike to abandon the use of a good coal, wood or gasoline stove," means likely the disinclination of the gasoline stove owner to part with an appliance that cost considerable money and is not worn out. In the majority of such instances he gave a range in exchange for the oil stove. He believed in removing every obstacle to the use of gas for any purpose, whether such practice meant the running of street services, piping houses at cost, or the sale of fixtures at very slight profit.

Mr. Harbison thought "Practice what you preach" was a good motto for gas men. As was well suggested by a previous speaker every gas manager ought to use gas exclusively in his own residence for domestic purposes. He had been doing that for some years in his home, in fact to the extent that not a pound of coal was consumed in it. The house was heated by steam raised in the stable some 200 feet away. The objection against heating water by gas was not a serious one, for he had now in use an instantaneous heater, made by parties in Chicago, that was capable of heating water for a bath in from 15 to 18 minutes. The cost of the apparatus was not at all excessive. He did not disagree with the idea that a nice kitchen was too expensive. Indeed he thought if the Superintendent was unable to fit up such a kitchen the Company should do it for him. With gas for cooking and with gas appliances for laundry work the kitchen should be as clean as the parlor. Servants have lots of visitors, and you may be sure that the latter will talk about what they saw in their friend's workshop. We are at present putting on gas in a row of flats, the owner of which proposes to have gas used in them exclusively for cooking. Two 3-inch services and 2-inch branches are going into each building, and the owner is paying the cost thereof. Nor is this an exceptional case with us, for at least 100 ranges will have been set in Hartford this year under similar conditions. He did not believe in small service pipes, nor did he quite agree with Mr. Jenkins that the Company should make all connections to the stoves. With them other people than themselves (the plumbers, for instance) sell stoves, and the Company did not want to interfere with the latter. The Company, however, did not fail to inspect the work after it was done, and they often advised the plumbers how it should be done. There was no doubt that gas fuel was the most satisfactory and economical fuel that could be used. In closing he remarked not only should the superintendent use gaseous fuel in his kitchen the year round, but that the other officers and directors should do so as well.

Mr. Neal said that neither the paper nor the discussion as yet had met his particular case. He used gas for fuel only for a portion of the year, and if he were to paint his kitchen white or even red, carpet it, provide a collation, and invite friends to inspect the working of his gas range at a time when the temperature was similar to that in the International Hotel yesterday, he thought his visitors would hurriedly depart for warmer quarters. His heating apparatus was on a level with the kitchen, he had no steam, and the gas range would not heat it. What was to be done in such a case? He would have to take part of the money saved by the use of a gas range and spend it in some way for heating the kitchen.

Mr. A. E. Forstall said that Mr. Doherty spoke of an instantaneous water heater under pressure, and he thought he must have had either a like one or its first cousin in use in his house for a season. He thus was in a position to form a practical and unprejudiced opinion of its merits. He was sorry to say that the heater was not a distinct success. He, however, stood it all summer, but was afraid to try it anywhere else. It would not supply hot water fast enough. As a bath heater it was all right, but it was useless for heating water on dishwashing account. Servants do not like to wait 10 minutes or more for hot water

for such uses. On washing days the same complaint prevailed. When the separate pilot light was in use the gas consumption increased wonderfully. In his belief the disadvantage was, no matter at how comparatively low a temperature you want the water, the ½-inch coil prevents its being drawn very fast unless a very high pressure is on the street main. Again, every time it is turned on each light in the house goes down and then up again. A 10-light meter furnishes gas for the stove and for this heater, pipe being taken off the service entirely separate from the lighting system The service is an old one, being only 1 inch in diameter, yet it was doubtful if a 1½-inch service of the ordinary length in our town would operate differently. The heater is on a separate meter, and its consumption of gas determined. Having small children in his family hot water was wanted on tap all the time, and a good deal of it was used. The gas consumption averaged not far from 100 feet per day. There was absolutely no restriction to the use of the hot water, and he supposed they used more than the average family. For the reasons stated he had not dared to recommend it to any of the consumers.

The President said he would like to have a voice in the discussion. He advised his Company to invest about $16,000 in the purchase of 1,000 stoves, which were subsequently loaned out, the people entering into a contract to return the stoves in ordinarily good condition. Our idea was that the stoves would average 1,000 feet per month, but after the test had been fairly made it was shown that the consumption of each was something over 1,800 feet. The Company wrote off every year 25 per cent. on the cost of the stoves. In other words, at the end of 4 years the stoves were clear on profit and loss account. The stoves returned to the Company were found in good condition. The charge for repairs was very small. Only one stove had been lost to the Company in the three years of the practice. They are constantly sought after. The Company has since the initial order authorized the purchase of 2,000 more stoves to be put out on the original plan.

Mr. Graves thought the Rochester (N. Y.) plant was of like capacity to that of the San Francisco plant. The Rochester Company followed the plan described by Mr. Crockett, for the past three years. Approximately the Company has out on contracts between 4,000 and 5,000 gas ranges. The Company insists that the user of the stove shall consume at least 500 feet per month, the gas rate on fuel account being $1 per 1,000. At the present time, when a customer signs one of those contracts a range that has been used is sent, for a few ranges, from one cause or another, are returned. People who ask for a new range are told that the one which will be sent them will be as good as new. No size smaller than an 18-inch lid is used, and the connection to the stove is ¾ inch. Those who desire to connect up their stoves are permitted to do so, but the Company's rules, as to piping, etc., must be adhered to.

The President said the main item of expense in keeping the stoves in repair was the retinning of the drip pan, which was done at a cost of 6 cents apiece.

Mr. Graves said the average expense of keeping the ranges in repair at Rochester was 10 cents each per year.

The President thought the average expense in San Francisco would exceed 10 cents, and asked if Mr. Doherty desired to say anything in reply?

Mr. Doherty asked Mr. Searle the population of the city where the 30,000 ranges had been put out. Mr. Searle replied he thought 12,000 stoves had been placed in Kansas City, Mo., in 16 or 18 months.

Mr. George Clarke remarked that the population of Kansas City was about 200,000. Free installation was the main inducement, and much active personal canvassing had been done. The gas rate at the time was 50 cents per 1,000.

Mr. Doherty did not think the peculiar conditions that existed at the time noted in Kansas City could be fairly quoted in this discussion. He did not believe in giving away stoves to induce people to use them. He thought "talk" more than anything created the demand for them. In Madison they could have given away stoves very readily. They charged for services something more than they cost, and charged $2 or $3 advance on the cost price of the stoves. In the last few years one gas stove had been placed in Madison for every 50 inhabitants. Madison was a town of 17,000 inhabitants, and a very large section thereof could not be reached by the Company, because the main system was somewhat restricted when the present owners took over the works. The business was secured by advertising and soliciting. He did not think the time was ripe for free installation. In their soliciting department they only wanted men who knew their business, and they paid them well, Mr. Searle said that a heater with an efficiency of only 35 per cent. is too expensive for use, and Mr. Doty declared he had a heater arranged with a thermostat that was satisfactory in its economical working. The speaker thought if the thermostat controlled the rate of flow of the gas the heater must have a very low efficiency, and he was surprised such good results were obtained from it. In a steam boiler plant the efficiency fell off when the grate surface was not working to its highest capacity. Mr. Pratt said he would remove all objections to the use of gas, in which event he would have to give away the gas. If we charge for services (I think most people will pay for services) we merely have that much more money with which to do something else, or are that much better off, and eventually we can sell gas cheaper. He did not say it was unwise to put in free service, but thought it often possible that one might be away ahead of the game. He noticed that many gas men present said they *believed* the use of gas was best in the kitchen, but he would discharge an employee who only "believed." He must be positive about it. Respecting cooking schools he would say that the past three seasons the Madison Company had in its employ a graduate of the "Boston Cooking School." When the speaker first took charge of the Madison plant their desire was to interest the women of the city in gas for cooking, and they did it by organizing cooking schools, and at the present time their efforts had been rewarded by the existence of an important organization known as the "Housekeeping League." In addition to three cooking schools they induced the city to take up cooking instruction in the public schools. The Company paid the demonstrator, furnished the room and supplied the gas free. The Company also gave free lectures in this line on public account. Careful track of all these efforts were kept, so they were able to trace the results coming from each division of the attempt to popularize the use of gas as fuel. It seemed that the teaching of cooking in the public schools reached just the class that they wanted to reach—that is, all classes; whereas the free cooking lecture did not. The trouble in the latter instance seemed to be that the same people attended each lecture. Mr. Searle spoke about giving away gas stoves to replace those of the gasoline type standing in the way. If you did not take from them the gasoline stove they were very apt to use it; but if you made an exchange the usefulness of the gasoline stove was done with. He had 14 gasoline stoves stored in an old barn. He had hoped that some things noted in the paper, that had not been discussed in the debate, would have been considered. For instance, he had noted that some complaints could not be cured, but he was now of the opinion that no matter what the grievance in hand, or how cranky was the person who made it, that the one could be explained and the other appeased. As to hot plates being the forerunners of gas stoves, he did not subscribe to such belief. He would rather sell gas stoves outright than try to sell people hot plates with the view of introducing gas stoves, for he really thought the plates stood in the way of placing gas stoves. They did not willingly handle hot plates at all. If people asked for them, and insisted upon having them, why of course their wish was satisfied. He thought they had sold two hot plates this year, for use in saloons. Mr. Doty had said that bones, ashes, garbage, tin cans, etc., and all such refuse, can be gotten rid of when a coal stove is used, but not so where a gas stove is employed. And that objection is sometimes good in a place where the proper arrangements for the removal of refuse is not practiced by the authorities. His opinion was that selling gas stoves on the installment plan was excellent practice, for they all knew how ready people were to buy something if they could only pay for it at the rate of $1 per month. Since that was human nature, they must take advantage of that desire on the part of the public. Mr. Littlehales stated that soliciting was worth more than all other methods of acquiring business, and he agreed with him thoroughly, but the way must be paved for your solicitors by advertisement and demonstration. The Madison Company paid its solicitors on the commission basis, and they were not discouraged when the people refused to let them in. After a time the objector was again tried, frequently with good results. Just before he left for the meeting he had taken snap shots of the exteriors of some houses in which gas was used for cooking. Those who cared to look over them might see for themselves that gas was being used for cooking in dwellings that were little more than mere huts. Furthermore, the occupants were paying their bills on such account promptly. Mr. Doty spoke about obtaining advertising matter from a central point. That certainly seems desirable, for it takes much time and work to write suitable advertising matter. In fact, the time put into writing adequate advertisements figures up as an expensive thing. Still he thought those doing business in different places knew best how to describe the conditions governing their own particular field of labor.

The thanks of the Association (on motion of Mr. Beal) were voted to Mr. Doherty for his paper.

The President then introduced Dr. E. G. Love, of New York City, who read the following paper on

THE LOSS OF ILLUMINATING POWER OF 25 to 30-CANDLE GAS WHEN MIXED WITH AIR.

In 1862, Messrs. Audouin and Bérard published, in *Annales de Chimie et de Physique*, the results of some experiments on the effect upon the illuminating power of gas of various admixtures of air. This table in a greatly abridged form has been frequently referred to by writers for the past 35 years, usually without any mention or even knowledge of its origin, or the conditions under which the tests were made. These experimenters used the low quality coal gas of Paris, and as they were studying a problem in street lighting they burned it in a bat'swing burner at the rate of 140 liters (4.94 cubic feet) per hour. They found that 1 per cent. of air reduced the illuminating power 6 per cent., 2 per cent. of air reduced it 11 per cent., 3 per cent. of air reduced it 18 per cent., and so on. The percentage of loss for each per cent. of air varied considerably according to the quantity of air in the mixture. Thus, the first per cent. reduced the illuminating power 6 per cent., but in a mixture containing 7 per cent. of air this had increased to 7.57 per cent., while in a 40 per cent. mixture each per cent. had a deleterious effect of only 2.47 per cent. Mr. R. H. Patterson, in commenting on these results in 1880, and without any knowledge of their authorship, except that they had been quoted by Dr. Letheby, expressed some doubts as to the correctness of the figures, as it did not seem to him probable that the first 10 per cent. of air added should reduce the light by 67 per cent., while the fourth 10 per cent. reduced it only 2 per cent.

In 1878 Mr. H. Aitken published some results on mixtures of air with gas of 27.8-candle power—probably a cannel gas. No mention is made of the burner used, but judging from the quality of the gas we should infer it was a flat flame, although the results obtained would indicate that an Argand was employed. His experiments included only four mixtures, containing respectively 0.5 per cent., 1 per cent., 5 per cent. and 10 per cent. of air, and the results show that the deleterious effect of each per cent. of air in these mixtures was 4.82, 4.42, 2.94 and 2.52 per cent.

Some figures were published by Mr. B. W. Smith in 1885, showing the effect of air on 16.6 candle coal gas consumed in an Argand burner. The mixtures employed contained from 0.25 per cent. to 3 per cent. of air, and the results show a fairly constant effect for each per cent. of air in the mixture, being 3.6 per cent. for a ¼ per cent. mixture, and varying from 4.2 per cent. to 4.62 per cent. for mixtures containing from 0.5 per cent. to 3 per cent. of air.

Dr. Schilling and Inspector Ries made some experiments in this direction in 1891, in which a coal gas of 19-candle power was used, and the tests were made with a slit burner. The mixtures contained 2, 4, 6, and 8 per cent. of air respectively, and the deleterious effect on the illuminating power of each per cent. was found to be 7.25, 6.70, 6.27, and 6.02 per cent.

It may be of interest in this connection to mention the experiments, by Dr. P. F. Frankland in 1884, on mixtures of ethylene and air. He tested six mixtures in which the air varied from 20.32 to 77.69 per cent. In mixtures containing up to about 40 per cent. of air, the percentage of loss corresponded with the percentage of air in the mixture; but from this point the air had a slightly increasing deleterious effect.

For convenience I have placed in the following table the results with coal gas just referred to, and I think you will admit that the record is rather confusing. (See top of next column.)

The work of Audouin and Bérard in this line was but a small part of an investigation on gas burners carried out under the direction of Dumas and Regnault, and for this reason, if for no other, is, I think, entitled to great weight.

It would be foreign to the purpose of this paper to enter into any extended examination of the results obtained on the deleterious action of air on coal gas, but there are one or two points to which I wish to call your attention.

It is generally understood that an illuminating gas of low quality suffers more by admixture with incombustible diluents than a gas of high candle power, and that in either case the injurious effect is much greater with flat-flame burners than with Argands.

If we assume that the figures reported by Aitken were obtained with an Argand, and we compare them with those obtained by Smith, we see that the deleterious effect of 1 per cent. of air is practically the same with gas of 17-candle power as with one of 28 candle power. On the other hand, if they were obtained with a flat-flame burner is it probable that the effect is so much less with a 28-candle gas than with a 14 or 19-candle gas, as shown by the tests of Audouin and Bérard, and of Schilling?

Percentage of Air in Mixture.	Audouin and Berard, 1862. 12-14-Candle Gas. Flat Flame Burner.		H. Aitken, 1878. 27.8-Candle Gas.		B. W. Smith, 1885. 16.6-Candle Gas. Argand Burner.		Schilling & Ries, 1891. 19-Candle Gas. Flat Flame Burner.	
	Loss per Cent.	Loss p.ct. for 1 p.ct. Air.	Loss per Cent.	Loss p.ct. for 1 p.ct. Air.	Loss per Cent.	Loss p ct. for 1 p ct. Air.	Loss per Cent.	Loss p.ct. for 1 p.ct. Air.
0.25	....	....	....	....	0.90	3.60	....	....
0.50	....	....	2.41	4.82	2.10	4.20	....	....
0.75	....	....	....	....	3.31	4.41	....	....
1.00	6	6.0	4.42	4.42	4.51	4.51	...	....
1.25	....	....	....	....	5.40	4.32	....	....
1.50	....	....	....	....	6.62	4.41	...	....
2.00	11	5.5	....	....	9.03	4.51	14.5	7.25
3.00	18	6.0	....	....	13.85	4.62	....	....
4.00	26	6.5	....	....	....	....	26.8	6.70
5.00	33	6.6	14.70	2.94	....	....	...	...
6.00	44	7.33	....	....	....	....	37.6	6.27
7.00	53	7.57	....	....	....	....	....	....
8.00	58	7.25	....	....	....	....	48.2	6.02
9.00	64	7.11	....	....	....	....	....	....
10.00	67	6.7	25.23	2.52	....	....	....	....
15.00	80	5.33	....	....	....	....	....	....
20.00	93	4.65	....	....	....	....	....	....
30.00	98	3.26	....	....	....	....	....	....
40.00	99	2.47	....	....	....	....	....	....
45.00	100		....	....	....	....	....	....

Moreover, it is a matter of surprise that in the Aitken experiments the effect of 1 per cent. of air in a 10 per cent. mixture should be only 2.52 per cent. while it was 4.42 per cent. in a 1 per cent. mixture.

Does the injurious effect of 1 per cent. of air in mixtures containing from 2 per cent. to 8 per cent. increase, as shown by Audouin and Bérard, or decrease as shown by Schilling? In a word, what is the effect upon the candle power of a coal gas of the addition of various proportions of air when the mixtures are tested in the consumer's flat-flame burner.

It may be possible to reconcile to some extent the results given in the table, but it seems to us that if this is done it must be by a more careful and extended study of the effect of air upon the different hydrocarbons which contribute light to the flame.

So far as we are aware no experiments have been made to determine the effect of air upon the illuminating power of water gas, especially that of 25 to 30 candle power; and we, therefore, offer the following results as a small contribution in this direction.

The tests here recorded were made in five series, each of which included a number of mixtures covering a wide range in the percentages of air and gas. Where mixtures in different series were found to have practically the same composition, the results obtained with such mixtures were averaged.

The illuminating power of the gas used in the different series was 26.36, 26.50, 26.48, 25.86 and 25.30 at 60° F. and 30-inch pressure, tested by the Bray Slit Union No. 7. This burner was also used in testing the air gas mixtures; and the consumption was in all cases regulated to 5 cubic feet per hour.

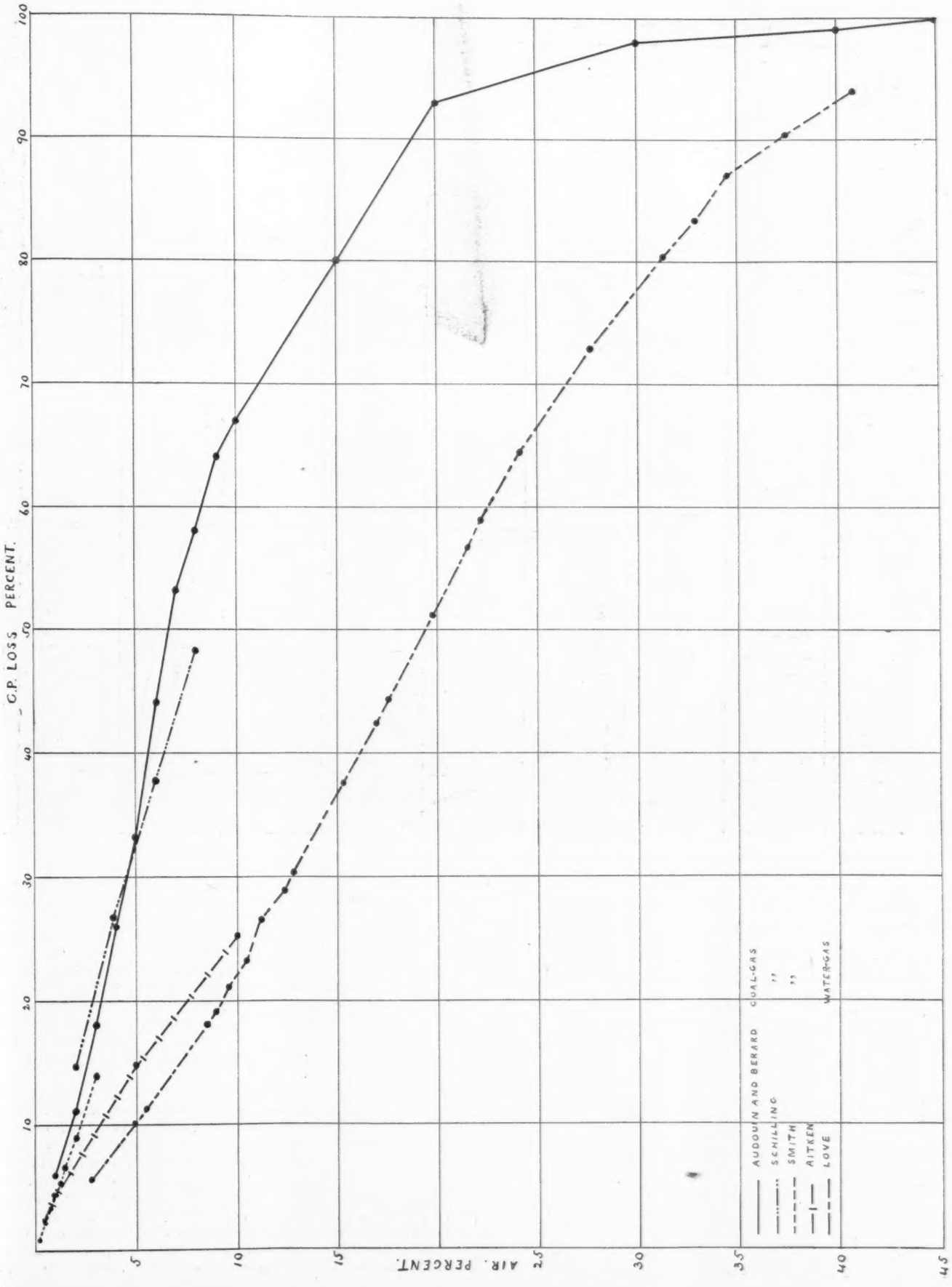
The mixtures of air and gas were made by measure, but these were checked by analayses of the mixtures, samples of which were taken in tubes placed just before the burner.

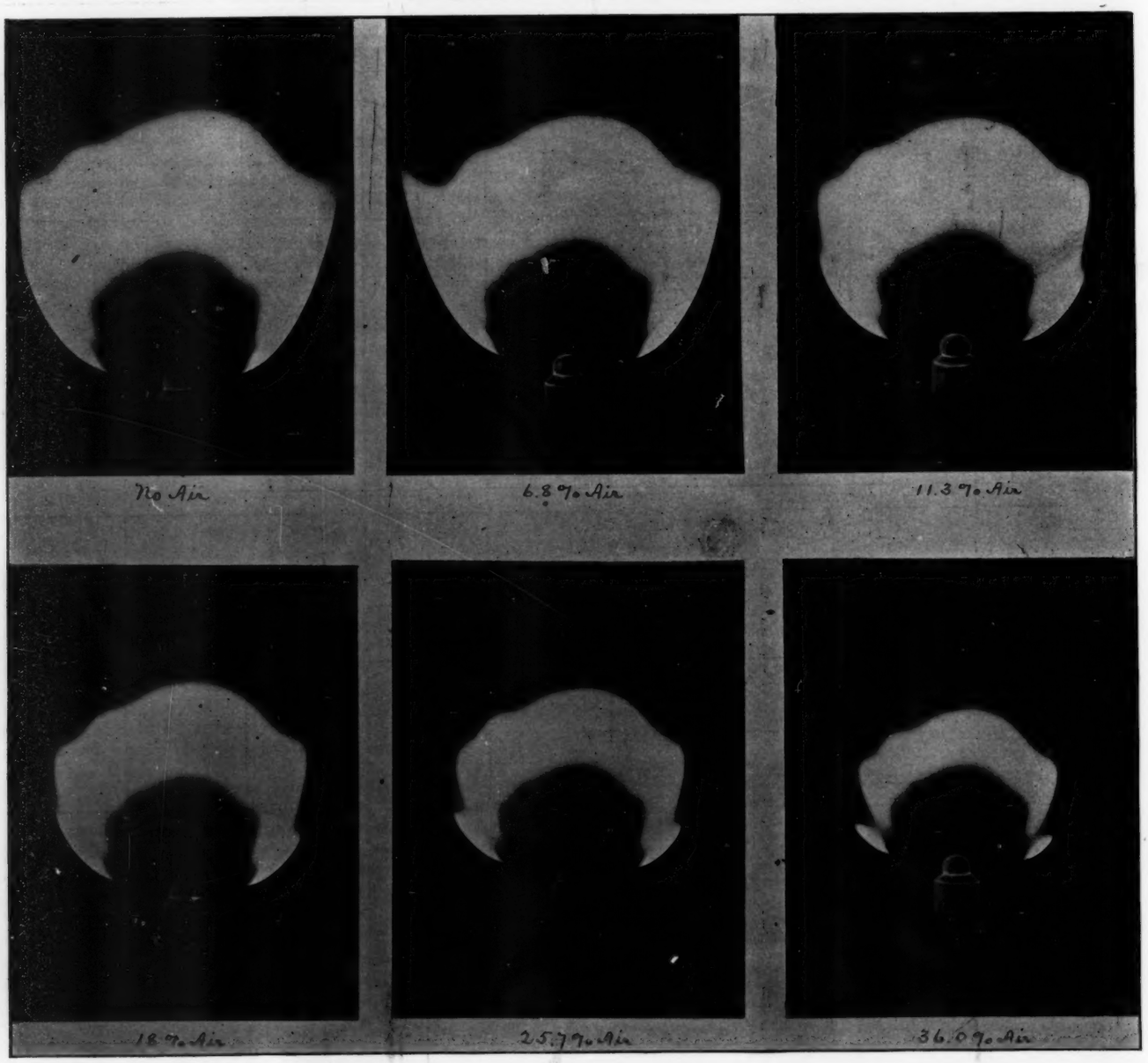
No attempt was made to test mixtures containing very small percentages of air, the lowest being 2.82 per cent., and increasing from this to 40.8 per cent., at which point the loss of illuminating power was 93.8 per cent.

The following table gives the results obtained:

Percentage of Air in Mixture.	Loss of Illuminating Power. Per Cent.	Loss of Illuminating Power for 1 Per Ct. of Air. Per Cent.	Percentage of Air in Mixture.	Loss of Illuminating Power. Per Cent.	Loss of Illuminating Power for 1 Per Ct. of Air. Per Cent.
2.82	5.72	2.03	17.65	44.30	2.51
4.94	10.08	2.04	19.84	51.19	2.58
5.40	11.24	2.08	21.56	56.69	2.63
8.51	18.04	2.12	22.22	58.88	2.65
8.95	19.06	2.13	24.16	64.51	2.67
9.62	21.16	2.20	27.69	72.82	2.63
10.40	23.24	2.24	31.30	80.44	2.57
11.20	26.66	2.38	32.95	83.36	2.53
12.35	29.02	2.35	34.53	87.02	2.52
12.81	30.48	2.38	37.50	90.37	2.41
15.25	37.66	2.47	40.79	93.82	2.30
16.98	42.28	2.49			

From this it appears that with low percentages of air the percentage of


C.P. LOSS PERCENT.
AIR PERCENT.
AUDOUIN AND BERARD COAL-GAS
SCHILLING " "
SMITH " "
AITKEN WATER-GAS
LOVE



loss is a little more than twice the amount of air present in the mixture; that as the quantity of air increases its deleterious effect increases in a somewhat higher ratio, reaching a maximum with about 25 per cent. of air, and that from this point the rate of depreciation gradually decreases until the flame has lost its illuminating power.

If these results are compared with those of Audouin and Bérard, it will be noticed that although the rate of loss is much greater in one case than in the other, the general distribution of this loss is practically the same in both cases. Owing, however, to the greater rate of loss in the case of coal gas, the practical disillumination of its flame occurs with a much lower percentage of air than in the water gas flame. Thus with a mixture containing 20 per cent. of air, coal gas loses 93 per cent. of its illuminating power, while with a corresponding mixture water gas loses only about one-half.

No very close comparisons can be made, however, between the results in the case of water gas and those obtained by Audouin and Bérard with coal gas, for aside from the difference in their quality the gas in the former case was burned under conditions best suited to develop its illuminating power, while the burning of a low quality coal gas in a flat-flame burner is a very effective means of destroying its luminosity.

On the accompanying diagram I have plotted the results referred to in the case of coal gas together with those obtained with water gas. The ordinates indicate percentages of loss in illuminating power, and the abscissas percentages of air in the mixtures.

As regards the appearance of the flame from a mixture of air and water gas, it may be said that, with mixtures containing about 5 per cent. or less of air, the eye alone is hardly able to detect any difference except with the help of a comparison flame, and even then the most noticeable change is a slight reduction in size. The addition of larger percentages of air produces very marked changes in the flame, which rapidly diminishes in size and has a dull and impoverished appearance.

The accompanying photographs, which are "life size,"[1] will give some idea of the relative sizes of flames consuming gas and different mixtures of gas and air, the consumption in each case being 5 cubic feet per hour. As these flames were photographed "instantaneously," and by means of their own light, the blue zone appears somewhat larger than it really is, since the more feeble light from the upper portion of this zone was not able to impress the photographic plate during the time of the exposure.

Although the Argand plays no part in the official testing or practical use of rich water gas, it was thought to be a matter of interest to know the effect of air as shown by this burner, and an effort was made to determine this, but the experiments were too few to warrant my giving any figures. It may be said, however, that the loss is very small. The presence of air is shown at once by the appearance of the flame, and indeed it is more noticeable here than on the photometer disc. The first effect is a shortening of the flame, followed by the disappearance of its reddish and more or less irregular tip, and a decided increase in the intensity of the brighter portion. This effect is merely intensified as the percentage of air in the mixture is increased, until with about 25 per cent. of air the height of the flame is reduced fully one-half.

1. In preparing the illustration the original was reduced a trifle.

The effect is similar to that produced by lengthening the chimney. It is very desirable that a careful revision be made of the results so far obtained on the depreciating effect of air on coal gas, and also that the experiments here recorded with water gas should be repeated by other members of the Association who may be more fortunately situated than the writer for carrying on such work.

Every experiment made with care and under known conditions is of value in reaching the desired result.

Discussion.

Mr. Wheeler said Dr. Love's paper was on a very interesting subject, and that the experiments he had made were within the reach of all. He hardly agreed with the author in the statement that a mixture containing only 5 per cent. of air was hard to detect. He thought to the contrary that gas men could quite readily detect the presence of 5 per cent. of air. In the field of 24-candle gas (half coal gas and half water gas) he had personally made a number of experiments, using as a diluent air, carbon dioxide and a heavy furnace gas, and had always found that a mixture of 5 per cent. of air reduced the candle power of the gas 13 or 14 per cent. Quite recently at his instigation experiments had been made upon a water gas of 22.9 candles, by Mr. Tuttle, at the gas works at Long Branch, N. J. The results showed that an admission of 5 per cent. of air reduced the candle power to 19.9, or 13.1 per cent., and that a further admission of 10 per cent. of air brought the candle power down to 15.7, or 31.4 per cent. Every precaution was taken and all necessary corrections observed for temperature, barometer, etc. The amount of air which can be admitted with safety during the process of oxide purification is a point bearing directly upon the candle power, and it can be safely said that beyond 2½ per cent. of air as a maximum limit we cannot go with safety, since the candle power begins to drop in a marked degree, and requires more oil added in the carbureter to offset the loss due to the admission at the purifiers. It is probably true that 1½ per cent. is the practice of most gas engineers in admitting air at the boxes. With this quantity some engineers claim that no extra oil is required, and even that there is a slight gain in luminosity, while others claim that, even with this small amount, a small percentage of oil has to be added to keep the gas at the required candle power. The subject of Dr. Love's paper is a very interesting one from a variety of reasons. Considerable experimentation has been made, not only in the ordinary way of mixing air with an enriched gas in certain proportions and then measuring the candle power with the photometer, but also in the way of measuring the luminosity of the same in a Bunsen burner, and these latter experiments are perhaps more interesting than the ordinary one of measuring the loss of candle power due to small proportions of air mixed with the gas. There is a line of experiments in the matter of testing the luminosity of gas in the Bunsen burner which I think are very interesting. They are certainly very important in the matter of manufacturing gas stoves and Welsbach lights. Prof. Lewes, at the 1897 meeting of the Incorporated Gas Institute, read a most interesting paper upon the theory of the atmospheric burner. In this paper he made experiments upon the amount of air, of nitrogen and of carbon dioxide required to render a 24-candle power gas non-luminous when consumed in a Bunsen flame. He found that one volume of gas required 2.27 volumes of air, 2.30 of nitrogen, and 1.26 of carbon dioxide, respectively, to render the flame completely non-luminous. In a 43-candle power gas 7.86 volumes of air, 4.71 volumes of nitrogen and 3.12 volumes of carbon dioxide, respectively, were required, to render this richer gas non-luminous. These figures, he said, reveal the interesting fact that with a rich gas far less nitrogen than air is required to bring about loss of luminosity, on account of the high temperature produced by the combustion of the heavy hydrocarbon with the oxygen in the air. In this series of experiments he said that while it required 5.38 volumes of air to render a 24 candle power gas completely non-luminous, it required but 2.27 volumes of air to render a 17-candle coal gas non-luminous. He also shows the difference in temperature between blue and green non-luminous combustion, and notes that green combustion requires 3.37 volumes of air. The theory of these mixtures and varying temperatures resulting therefrom is very important indeed in the manufacture of scientifically constructed gas burners for stoves, and has a most important bearing upon the whole question of fuel gas. The experiments of Prof. Lewes to which I have referred are classical in their thoroughness and beauty, and his paper should be on the desk of every manufacturer of gas stoves as well as upon that of every gas man.

The President invited Mr. A. S. Miller to speak on the subject.

Mr. A. S. Miller said that to him Dr. Love's experiments appeared conclusive to the point of not leaving anything to criticize. It was a great pleasure to have the subject cleared up, since there had been so much wild guessing and so many loose statements made on it that he had begun to feel that none of them knew exactly where they were. He was very glad indeed when Dr. Love agreed to do this work. He was certainly under very great obligations to the author personally for so thoroughly clearing up the subject.

Mr. Doherty asked Dr. Love if the photographs were taken under exactly the same conditions, with the camera at the same distance from the flame, the same time of exposure given, and with the same diaphragm.

Dr. Love—Identically the same.

Mr. Searle asked Dr. Love if in any of the photometric observations it was possible to have had the camera so designed that the lens could have been subdivided by a dividing engine to get the flame area on the photograph.

Dr. Love replied it would have been possible, but that it had not been done because of the amount of labor involved, which time had not been at the author's disposal.

Mr. A. C. Humphreys said that in the spring of 1882 he had experimented considerably in mixing air with rich oil gas to determine the effect thereof upon candle power, and while he had not the figures with him, he had the general results in mind, which went to show that the figures previously published were absolutely misleading, if taken as results for general adoption, and without regard especially to the candle power of gas. But little work was required to demonstrate that with a rich oil gas a considerable percentage of air could be introduced, and the candle power of the gas would not be decreased as far as any practical results were concerned. He thought that was one of the chief points to be borne in mind in this connection. They must have clearly in mind in the first place what the candle power of the gas was before attempting to determine what will be the result on the gas of mixing it with air. A great deal of instruction could be derived from the general subject of photography. They only had to make a few experiments in this direction to determine that they had nothing like absolute candle power to guide them. He could, for instance, in an ordinary burner consume a quantity of oil gas much too great for the particular burner, with the result that a low efficiency would be shown. He adds 40 per cent. of air and by carefully and laboriously arranging a burner that would burn that gas to the greatest advantage, he could get a better result from the addition of that 40 per cent. of air than if the air had not been added. He mentioned this to show that the subject could not be treated in any general way. Practically, however, Dr. Love had covered the subject for their ordinary business practice since he had shown the effect of air on gas as ordinarily used. He suggested, however, that very likely the difference in effects shown between water gas and coal gas was due in great measure not to the difference between coal gas and water gas, but to the difference in candle power between those two gases.

Mr. Littlehales asked Dr. Love if the relative areas of the photographs indicated the relative illuminating power; or was a portion of that due to the actinic power of the flame? Would the relative sizes of the white portions indicate the relative illuminating powers of the different photographs?

Dr. Love said that in answering Mr. Littlehales' question he would merely state, as he had tried to in the paper, that the photographs did not give actual sizes, as the actinic rays were the only ones that affect the photographic plate; for which reason the very dull yellow rays found in the upper portion of the blue zone showed the difference between what they had been speaking of and what was the luminous portion. There was really no such sharp demarkation, but there was a gradual gradation. The photographs were all taken at the same distance; but the flame itself was somewhat reduced. For instance, he had made measurements of the height of the luminous portion of the flame on the ground glass before making the exposure, and did so in order to get identically the same amplification and so that they would all be of the right size. He found as expected that the upper portions of the luminous zone did not impress the photographic plate in exactly the same way as the lower portions did. They represented merely the effect of the actual rays in this flame on the photographic plate. To a certain extent they were relative. It interested him to gather in series in that way flames under the same conditions identically, so as to show the effect of the air. Of course the addition of air immediately produces a dullness which is apparent in the flame. Respecting Mr. Wheeler's statement that 5 per cent. of air could be detected in the flame, he rigged up his photometer with two flames, each burning the same gas under the like conditions; one consumed gas without the addition of air, and the other had an addition of 5 per cent. of air. He

might not have been a very good judge, but he could not tell the difference, and he was not only looking for a difference, but wanted to find it. He would like any gentleman to make the test, by burning a mixture of gas with 5 per cent. of air, to determine if he could tell by the efficiency of the flame whether or not there was air in that gas. As far as he could tell it had the bright appearance of good, rich water gas. He could not see any of the impoverishment appearing in the flame which was apparent afterwards when the mixture of air exceeded 8 or 10 per cent. Of course the subject was one which immediately suggested an almost infinite number of paths that can be followed out with interest; but some of them were more interesting to him personally than the exact one which he followed, because that work was always very suggestive, and led to the conclusion that, after all, as Mr. Humphreys said, we knew comparatively little about it. One may adapt his mixture to certain conditions, but those are not the conditions in practice at all. It was merely a matter of scientific investigation under those circumstances. Here he aimed to make it a thoroughly practical question that might be of some assistance to the gas fraternity.

Mr. Littlehales asked if it would not have been a fairer test, for the sake of argument, to assume that if 25 per cent. of air had been added, and the test made with a 4-foot burner, than to have the test made with a 5 foot burner?

Dr. Love answered that question by asking whether he would have done that in the case of a consumer.

Mr. Littlehales—No.

Dr. Love said he judged it from the consumer's standpoint. With a 5-foot burner you would oblige your consumer to increase his consumption of gas.

Mr. Littlehales suggested that he was looking at it only from the standpoint of its deterioration.

Dr. Love said there was no doubt about that. If they wanted to burn gas scientifically they must change their burners and change the conditions. The moment they introduced any new element the value of the test was materially impaired.

Mr. A. E. Forstall remarked that the difference between Dr. Love and Mr. Wheeler was but another illustration of the silver and gold shield. Was it not possible that the composition of the two gases experimented with, the one by Dr. Love and the other by Mr. Wheeler, might make a difference in the visible influence of the admixture—so that both of them might be right.

Dr. Love said he assumed that Mr. Wheeler was right and that he was wrong; it was his inability to make that distinction. The point suggested is one that he had laid some slight stress upon, in that it was not so much the candle power as the carbon constituents which make up that candle power. He introduced that extract from Mr. Frankland's work to show that he took ethylene to experiment with. There has been almost no work done on that line. They knew what the effect of air was on flame, but they did not know the effect of air on its admixture with various constituents. It seemed to him they must ascertain that in order to get at the bottom facts. He had worked on a gas that was practically 2 candles higher than that named by Mr. Wheeler. Naturally the higher the candle power the more air the gas will stand, which he thought had been abundantly proven by the experiments that had been made.

On motion of Mr. A. S. Miller a hearty vote of thanks was passed to Dr. Love for his kindness in presenting the paper to the Association.

At the suggestion of the Secretary, who said the time to recess was insufficient to permit of the reading of another paper, the

QUESTION BOX

was opened, and this query was discussed:

> "Why not make the union on 3-light meters the same as on 5-light, so as to be interchangeable?"

Mr. Littlehales thought that such practice would be an excellent one to follow.

Mr. A. S. Miller said he did not suppose there was a meter user present who would not like to see that done. If there were any practical objection to the proposition, perhaps some of the meter makers would state it.

Mr. McIlhenny thought there was no practical objection towards making such interchangeability. Of course they all knew there were many more 3-light than 5-light meters in use—perhaps 10 of the former to 1 of the latter; and the greatest part of the objection would likely come from the gas companies themselves, on the score of causing confusion in making connections and the cost of changing the same, which included charges for lead pipe, soldering in new caps, etc. He did not see, though, any advantage in putting a 5-light screw on a 3-light meter, presuming that the latter was large enough for the use to which it was being put.

Mr. Harbison thought a good answer to the question would be to say to discontinue altogether the 3-light meter, for he thought the latter was not large enough to meet the wants of ordinary consumers. The Hartford Company had determined not to place any more 3 light meters.

Mr. Boardman thought Mr. Harbison's views were correct in the case of a large company, but it should be borne in mind that some of the small fry had a goodly field for meters of the 3-light class. In small shops they were glad to supply gas to 2, 3 or 4 burners, and in such cases the 3-light meter was ample. If such places, through the placing of a radiator, a gas stove or other appliance, so increased their use of gas that a 5-light meter was necessary, why it was an easy matter to put it in. Then they had the 3-light that was removed on hand ready to put in another place which would only take a small quantity of gas. He believed, however, in the proposition to make unions interchangeable, and would go to the point of having it understood that the meter makers, unless otherwise instructed, would furnish such couplings.

Mr. W. M. Cathels called attention to the fact that the men of large ideas usually represented large companies, which was Mr. Harbison's good circumstance, but some, like the speaker, represented smaller concerns, that did not feel the necessity of going in for things on the big scale. A 3-light meter would deliver gas to 7 or 8 ordinary burners, which, if constantly kept going, meant a pretty good consumption. In fact, in most houses 3 to 5 burners will be the average used. Of course, the addition of a stove would make a difference. He believed in the idea of standardizing the couplings, but he did not advocate the disuse of 3-light meters.

The Secretary read the following written answers to the question:

"It would certainly be a great convenience, and I favor it very much."—NORTHROP MOORE.

"I say Amen to this question."—J. W. GWYNN.

"It would make trouble in small works from mistakes in setting a 3-light where a 5-light was barely sufficient. Why not abolish the 3 light meter."—M. BOWES.

Mr. A. E. Forstall said as far as he was concerned he thought the 3 light meter was useful in many places where a 5-light meter was not needed. There was a little difference in cost between a 3-light or 5-light meter, and most of them had some meters that were not profitable, in which event there would be small economy in using a 3-light instead of a 5-light.

Mr. Littlehales said the present tendency was to use smaller meters. The great number of Welsbach burners in use reduces the consumption per burner enormously, and often a 3-light meter that was barely sufficient when they were supplying 5 or 6-flat flame burners was ample when the latter burners were replaced by Welsbachs.

The Secretary—Another question is:

> "What is the best method of separating the oil vapors from water gas, without the use of water? If water has to be used, what is the effect on the candle power?"

Mr. A. S. Miller said the Committee on Research had that as a standing subject, and hoped that some member would kindly enlighten them thereupon. He had spent much time and money investigating the subject and had tried to persuade some of the other members to do likewise. He used the ordinary scrubber, made up with slats an inch square and an inch apart, built so as to break the joints, and took the gas beyond the relief holder and cooled to 80°. The ordinary scrubber took out a portion but not all of the tar. He had used the P. & A. condenser, putting the gas through it at all rates of speed, from barely flowing through a 6-inch condenser to flowing beyond its rated capacity. Not knowing exactly what its rated capacity was, he weighted the float so as to run it under very considerable pressure. That did not do any good. Then one or two special scrubbers were designed by his assistants, and by Mr. Rusby, of Jersey City, but they did not answer the purpose. Finally he filled the pipe with shavings, and passed the gas through. There was no question but that took out the tar. He had just ordered 6 scrubbers, 10 feet in diameter, each one to contain 24 vertical feet of shavings. He thought this system was in use at Omaha, and Mr. Knapp told him it was working satisfactorily. In connection with that work he had made a great many tests of candle power to determine how much of it he was losing in the various scrubbers—the gas was about 27 or 28 candles. As the slat was a failure he did not try for candle power there, but de did test the P. & A. scrubbers and found the gas lost about 2 per cent. of its illuminating power. The

loss was about the same in the shavings and in the purifying processes where the gas was not scrubbed at all, so that the loss was not any greater in the scrubbers than in the boxes. He did not, however, test the gas that had been scrubbed through the shavings scrubber, and again after it had been scrubbed through the purifying process. In other words he might lose 2 per cent. in the shavings scrubber and again lose 2 per cent. in the purifying boxes. Now they had made connections so that all of the gas passed through the first box in each set of purifying boxes, which box was filled with shavings. First they filled it in the ordinary manner, as with oxide, and found that while there was scarcely any back pressure it did not take the tar very long to get through the shavings. Reducing it to figures, the tar began to show on top of the purifying boxes when perhaps 3,000 or 4,000 cubic feet of gas had passed per bushel of shavings. He then decked the box over solid, about midway opposite the inlet, so that the gas had to come up and travel horizontally through the bed of shavings, then rise through an opening, and pass again horizontally through the shavings by another solid deck on top, and then out, in that way passing a long distance through a narrow body of shavings instead of a short distance through a very large space. That plan had brought the efficiency up to from 35,000 to 40,000 cubic feet per bushel of shavings. When the new scrubbers had been operated he would be pleased to tell the Association what the results were.

Mr. Somerville asked Mr. Miller if he took the temperature of the gas at the P. & A. condenser? He thought if the temperature was high the tarry matter would get into the scrubbers, but if it were cool the P. & A. apparatus would take out the tar. He would like to know what was done when the shavings were saturated with tar.

Mr. Miller said the gas came out of the regular condenser at about 80°, and the gas in the P. & A. apparatus was tested between 75° and 80°. The shavings would have to be renewed when from 35,000 to 40,000 cubic feet had been passed per bushel.

Mr. Egner said he had used shavings 14 years ago on water gas with similar results to those reported by Mr. Miller. The speaker, however, used the shavings in the lower one of the purifiers. They were very effective.

Mr. Knapp said the reason he put the shavings in a separate scrubber in the Omaha instance was to increase the depth of the oxide in the boxes, and take out one of the lower trays. They put in the old works at Omaha a scrubber 8 feet 6 inches in diameter, and 22 feet deep, filling in the slats, and using water. Believing it was wrong to put that in at that point, he asked permission to try the shavings. He placed two layers of shavings, 2 feet 6 inches in diameter and something less than 2 feet deep. The first shavings used were too dry, the consequence being that they had to be removed on account of the back pressure. The next charge of shavings was wetted, and he passed 35,000 to 40,000 cubic feet of gas per bushel through them, without any tar showing through the layers. Then he gradually increased the length of time. On the last change they ran for over six months, and they put through about 90,000,000 cubic feet of gas per bushel. The tar was kept out of the boxes, but it discolored the shavings all through. Occasionally back pressure would be developed, but that was overcome by turning the exhaust from the exhauster right into the pipe. Regarding the loss of candle power, the gas was tested for several weeks on each side of the shavings, without showing any difference in the illuminating value. For some time he had been scrubbing the gas beyond the relief holder, and removing the tar by means of a centrifugal fan. He thought that if they ran a fan on a vertical or a horizontal shaft, they would have a separator and exhauster in one, and believed they would then get rid of the last particle of tar.

The Association then adjourned to Thursday, October 20th, at 10 A.M.

SECOND DAY, OCTOBER 20, MORNING SESSION.

The Association met, pursuant to adjournment, and the President introduced Mr. J. M. Rusby, of Jersey City, N. J., who read the following paper on the

DEPTH OF FIRE IN A WATER GAS SET.

In addition to a brief general consideration of the subject of this paper, a few special tests, analyses, etc., have been made to settle certain points touched upon. These tests were made in conjunction with our regular daily operation. Our results having been much affected by some of them while in progress, they were necessarily short and irregular, and were not in every respect successful. Certain facts are clearly brought out by them, however.

These tests were made upon a standard double superheater Lowe water gas setting. The oil used was naphtha; coal, anthracite, "broken" size. Size of set, 5 feet internal diameter. All steam supplied to generator was generated in a separate boiler, and water carefully weighed.

The conditions, results, etc., for the first set of tests are as follows: Depth of fire, 7 feet; length of run and blow, 7 minutes each; up-and-down runs in equal proportion; power consumed in blasting, 24 indicated horse power; blast "head" on fire, 7 to 8 inches water pressure; cleaning every 12 hours. Average gas (corrected) made per run 8,450 cubic feet; steam consumed in generator per 1,000 cubic feet of gas made, 32 pounds; generator fuel results good; heats in carbureter and superheater good; oil results very good; results very uniform on all tests.

For the second set of tests the conditions, results, etc., are as follows: Depth of fire, 3 feet; length of run and blow, 7 minutes each; up and down runs in equal proportion; blast "head" on fire, 4 to 6 inches; power consumed in blasting, from 8 to 14 indicated horse power; cleaning every 7 hours; gas made per run, 5,200 to 5,700 cubic feet; steam consumed in generator, per 1,000, 45 to 51 pounds; gross generator fuel charged per 1,000, 16 per cent. greater, and net generator fuel (gross less ash, etc., recovered) about 6 per cent. greater than in above set of tests; heats in carbureter and superheater very fair; oil results good, but slightly inferior to those on preceding tests.

In the third set of tests the depth of fire was 3 feet; length of run, 7 minutes; length of blow varied, on the different tests, from 7 minutes to 3 minutes; up and down runs in equal proportion; blast "head" on fires averaged about 5½ inches; cleaning about every 7 hours; gas made per hour, only about one-half what it had been with 7 feet fire; steam supply to generator in these tests was reduced to a little more than half of the rate per minute at which it was supplied in the two foregoing sets of tests; the amount consumed per 1,000 feet of gas ranged from about 40 to 55 pounds; gross generator fuel charged per 1,000, almost exactly the same, and net amount about 10 per cent. lower than in above first set of tests. The best fuel results were obtained, as might, I think, be expected, with the shortest blows, the temperature of generator fire being kept lowest. The heats in carbureter and superheater were difficult to control and were generally dull. Oil results very bad.

A number of analyses of blast gas were made during the progress of tests. Holes were drilled through the side of the generator at different heights above the grate, and through these perforated iron tubes were thrust horizontally, gas being thus collected from all parts of the fire. In nearly every case, even with heaviest blast employed, no oxygen could be found even 2 feet above the grate, its combustion being complete at that point. As the temperature of fire rose, during the process of blasting, the conversion of carbonic acid into carbonic oxide was almost coincident with combustion; with a 7-minute blow, even at 2 feet above the grate, the carbonic acid which, during the first minute of blow was 16 per cent. to 17.5 per cent., would drop during the last minute of blow to from 7 per cent. to 10 per cent. The temperature of the fire was, of course, very high at from 2 to 3 feet above grate, diminishing toward the top of fire. As might be expected, the conversion of acid to oxide was increased, other circumstances being the same, by increase in depth of fire, the percentage of oxide continually increasing toward the top of a 7-foot fire; owing to the low temperature of the top part of fire, however, this increase was small, the chief conversion taking place in the hot belt 2 to 3 feet above the grate. The effect on formation of oxide of prolonged contact of blast gas with fuel bed was very plainly shown by suddenly partially closing the blast valve at any moment until the flow of blast gas was about one-half its regular rate; the percentage of oxide would increase in every case by 8 per cent. or 10 per cent., samples being taken at a point 5 feet above the grate. The conversion of acid into oxide can be controlled by shortening the blow; with a 7-foot fire and a 7-minute blow, the acid ranged anywhere within the limits of 17 per cent. and 7 or 8 per cent.; with a 3-minute blow, it seemed capable of being confined within the limits of 16 per cent. and 11 per cent. to 12 per cent. The percentage of carbonic acid is lower by 2 per cent. or 3 per cent. after a down run than after an up run, this additional conversion to oxide being caused by the hotter fire after down run.

A few analyses of water gas were also made. It was expected that because the fire was hottest at the bottom, and an excess of steam is admitted to the fire, the percentage of carbonic acid in the gas would be lowest at the bottom of a 7-foot fire, and would also be lower, at least at the beginning of run, with a shallow than a deep fire. In the few analyses made, neither supposition was found true, although differences were not great. The carbonic acid in the uncarbureted gas would increase by from 2 to 2½ per cent. from the beginning to the end of a

7-minute run. It was decreased quite materially by a shortening of blow and decreasing of steam supply.

The following is a brief discussion of the above data :

It is to be borne in mind that in the making of a plain water gas, and the making of a carbureted gas, as with the Lowe apparatus, the objects are very different. In the former the object is to store in the fire all heat possible. In the second, a certain amount of heat must be stored in the fixing vessels for the gasification of the oil, and this heat may be either the sensible heat of the products of combustion or that produced by the burning of carbonic oxide formed in the generator; this absorption of heat is a process requiring time.

Comparing the first and second set of tests described above, we find a very greatly increased capacity per minute and run as the result of increasing the depth of fire from 3 feet to 7 feet. Although no actual measurement of quantity of air was made, I am positive, from the blast "heads" on the respective fires, that the air admitted to the shallow fire was at least as great as to the deeper one. Consequently, and in view of the fact that combustion was in all cases complete within 3 feet of the grate, the increased amount of gas made per minute and per run must be due to the absorption of the sensible heat of the blast gas by the upper 4 feet of fire. This increased capacity does not, of course, mean a corresponding increase in economy of fuel, for simultaneously with this absorption of heat much carbon is carried away from the fire by the carbonic oxide formed. The fact remains that the upper portion of fire served greatly to store heat during blast, giving it out again during run to make water gas, and also raise its temperature, the latter assisting the carbureter and superheater in the work of vaporizing the oil and making this process much more regular and easily controlled. An unquestionable advantage of a shallow fire (or its equivalent, a specially blasted deep fire), is a large saving of power in blasting, and the reduction of size, cost and speed of blowing machinery. The saving in cost of machinery will be largely offset, however, by the increased cost of a larger or specially designed generating vessel which shall give the same capacity per minute as the deep fire apparatus. If an enlarged generator of the Lowe type be used, it is almost certain that the steam consumed in generator will be considerably greater than with deep fire, this tending to offset the economy of steam used in blowing engine. It is also a question whether it would be possible to blast the shallow fire so as to satisfactorily heat the fixing vessels, with any considerable economy of generator fuel.

The quality of fuel used, coarse or fine, will largely affect the depth of fuel bed which will best be used. I believe that, with the kind of fuel used in our case, a fire of moderate depth, 5 to 6 feet, combined with short blow, will give the best result in all respects.

[To be Continued.]

Reuniting Broken Iron Castings.

By Mr. Thos. F. Kennedy, in *Metal Worker*.

As to reuniting broken iron castings, I don't know that I have a single idea that will be new to those who are familiar with the literature of iron founding, even though they are not practical foundrymen. But I do know that there are plenty of molders and foundrymen who may have some knowledge of the operation, yet never saw it performed, and I am sure there are thousands of molders, especially those working in stove and other light specialty foundries, who don't even know that such a thing is possible, though it is nearly akin to what they practice or see practiced every day they work in a stove foundry. My attention was directed to this fact very forcibly recently, when upon reuniting a broken casting a molder of ordinary intelligence, who has been foreman of a foundry and has worked in the stove and jobbing foundries of one of the greatest foundry districts in the country for 25 years, told me that he had never even heard of it before, and not one of the 30 other molders had ever seen it tried, and very few knew that such a thing was possible.

The first step is to make a mold off the broken casting. As there is no molten iron to go into it only right at the fracture there is no necessity of being particular, except at that point. A good impression is all that is required for the rest of the casting, but in bedding it in to get this impression it is absolutely essential to success that the exact alignment of the casting before it was broken be preserved.

Small and medium size stove patterns furnish plenty of opportunities to practice this kind of repairing. It is, however, almost impossible to align a broken stove pattern in a mold without some guide. If there is a good follow board or match the pattern casting can be aligned on it, and securely nailed that it may not shift while the nowel is being rammed. When the nowel is rolled over, the pattern will come out with the board, the nails can be withdrawn, and the pieces returned to their places in the mold. If there is not a good match or follow board get the best casting obtainable which was made off the pattern before it was broken, use the casting to make a nowel, when rolled over compare it with the pattern in its two main directions, and if there is any shrinkage, rap the casting enough to compensate for it. When drawn the broken pattern will fit snugly in the impression left.

When the broken casting, whether pattern or otherwise, is well disposed in the nowel, put in the gate sticks. If it is a small piece of regular shape one round gate on each side will do. Place them exactly opposite the fracture and closer to the casting than for an ordinary mold. However, variations almost innumerable can be made in the gating to suit the size and shape of the piece under treatment.

Ram the cope now and as soon as it is lifted off draw out the broken casting. Let some one who is handy with a cold chisel chip about ¼-inch off one of the fractured ends, or if the casting is only a small one it can be put on the emery wheel and a little ground off each end. If the cut is all taken off one end the other should be freshened a little with a file or chisel, enough to remove rust or any other substance that might have accumulated on it.

While this is being done let the molder cut runners from both gates to the impression. Cut them ¼-inch wide and as deep as the casting, in both parts of the mold, if it extends into the cope. Cut a channel ⅛-inch deep and ⅜-inch wide from runner to runner in both parts of the mold, so that the edges of the fractured ends will not touch the sand when the pieces are returned to the mold, but will allow the molten iron to form a scarf around the ends of the casting.

When the runners and scarf are cut and the cut taken off the ends return the pieces to their respective places in the mold. Note whether the runners agree exactly with the interstice between the two parts of the casting. If not, correct so they will and close the mold. Build up one of the gates a little to insure an overflow from the other, provide for the overflow iron and the mold is ready to pour. Always be sure that the sectional area of gates and runners is greater than that of the interstice.

We now have our broken casting in a mold true to its original alignment, with a section cut out at the fracture, leaving a space between the two parts and with gates and runners leading to and from it. The object is to force a stream of molten iron through this space under slight pressure, bringing the moving molten stream in contact with every part of the exposed ends. The fresh hot iron being poured in at one gate displaces and forces out at the other gate that which went before and has lost some of its heat.

It must be evident to any one with even a modicum of knowledge of such matters that if we can keep a stream of molten iron moving across the exposed ends it will be only a matter of time until the ends fuse and the three irons—the two ends and the molten section—become one body.

The amount of iron or length of time this will take depends on many things, but principally on the heat of the iron and the size of the casting. I have seen a small stove pattern firmly united by pouring about 5 pounds of molten iron through in 30 or 40 seconds. The iron used was very hot; indeed, it is impossible to do such work without at least fairly hot iron—the hotter the better, and the less will be required.

Not all castings can be made good as new in this manner. Some it would be impossible to align accurately; others it would be difficult to fuse owing to their having thin ribs or flanges where the iron would not circulate. Still, after making due allowance for all this there are many small castings of various kinds which get broken, and which can be made whole in this manner. In fact, it is not the size of the whole casting that is so much a bar as the size at the fracture. A very large and expensive casting may have a small lug or other projection broken off that will render it useless unless it can be replaced, and it is in work of this kind that the jobbing foundries practice this operation.

When a casting gets broken at a considerable distance from where a duplicate can be obtained it is often worth many times what it would cost in the regular course to have it made good as new in a few hours instead of as many days. In case of a casting upon which there is much finishing work it is at all saved except right at the fracture, if it can be successfully treated in this way.

Stove patterns, with a few rare exceptions now and again, are made of cast iron, and in the best regulated foundries get broken occasionally. When a pattern meets with a mishap it is more than likely to give way at the weakest point, of course, this is the most difficult point for the pattern maker to put on a patch. If the weakest point is where the pattern is narrowest and thinnest that makes it all the easier for a molder to mend it by the method described here. Take a square stove

side or a range front, patterns easily broken, because of unequal width at different points. Who has not seen an unsightly patch of some kind of sheet metal on a side pattern, which, no matter how skilfully applied, destroys the symmetry of the casting, and on the face side leaves its mark on every mold? I have seen plenty of such patterns mended with one of these unsightly patches, which I am sure could have been mended by a molder at a less cost, be more enduring and, most important of all, bring the pattern more nearly to its original form.

The writer has had no opportunity to experiment as to how large a casting can be treated successfully in this way, but has reunited a thin stove pattern 3 inches wide. The trouble is not in obtaining a perfect union, but from the shrinkage, for the molten section will want to shrink while the remainder of the casting will not. In the case of small castings, say up to 2½ inches, this movement is so small as to be hardly noticeable, and as it is patterns and parts of patterns about this size and smaller that get broken most frequently, even with the limit of its application restricted to patterns less than 3 inches wide there would still remain plenty of opportunities to practice this operation.

The Semet-Solvay Bye-Product Coke Oven Plant, Ensley, Alabama.

In a paper on this subject, read by Mr. W. H. Blauvelt, of Syracuse, N. Y., at the recent meeting of the American Institute of Mining Engineers, the author said that the ovens at the Ensley plant are of the Semet-Solvay horizontal flue type. In this oven the designers have developed the principle that the flue walls should be thin, to permit the ready passage of the heat to the coal, and that the weight of the top of the oven, which is necessarily thick and heavy to retain the heat, should be removed from the thin, almost white hot flue walls, and carried independently. A solid firebrick wall, 18 inches thick, is therefore placed between each two ovens to carry the load of the roof, coal cars, tracks and whatever may be placed on it. Each oven, therefore, has its separate set of flues, which may be entirely removed if necessary without affecting the general structure; and, carrying no load, they are free to expand and contract with the changes of temperature incident to the introduction of the cold charge and its heating up to the point necessary to complete the coking process. Moreover, the thick brick walls form a reservoir of heat that is of considerable assistance in keeping the temperature of the oven uniform. Thus the design of the oven is such as to give a maximum life to the flues (which are the only part of the oven that can wear out), while at the same time it admits their ready repair, should it be necessary, without affecting any other ovens in the block. The plan of introducing the gas in several places and at the ends of the horizontal flues gives perfect control over the heats in each flue, and permits their examination at any time to see that the proper temperatures are maintained. This arrangement insures that each flue shall have just the temperature best suited to the work to be performed, and prevents one part of the oven being overheated while another is too cool.

The plant of Semet-Solvay ovens at Ensley consists of 120 ovens, arranged in two parallel blocks of 60 each. The coal used is the washed slack from the Pratt seam, and it is expected that the plant when in full run will produce from 420 to 460 tons of coke per day. This coke will be consumed by the Ensley furnaces.

In the design of the plant careful attention has been given to the problem of handling materials with a minimum of labor, and at the same time elaborate handling machinery has been avoided as being unsuited to the class of labor most available. A spur from the track leading from the Pratt coal mines and washers is carried directly over the coal bins above the ovens, the track having a grade at the steepest part of 1.05 feet per hundred, so that a locomotive can deliver a day's supply of coal at one shift. The coal is delivered in 30-ton cars with sloping hopper bottoms, and one laborer can easily dump in ten hours the whole day's supply. The bins have a capacity of 1,500 tons of coal, to provide against any irregularity in the supply. The coal for charging the ovens is drawn into larries below the bins and charged into the ovens.

When coked, the charge is pushed from the oven by a steam ram and quenched as it falls on to a car provided for the purpose. This car is 30 feet long and 7 feet wide, with a sloping bottom, and is so arranged that, when pushed out on it, the coke lies in a thin even layer that permits complete quenching with a minimum resultant moisture in the coke.

The blocks of ovens are located at right angles to the line of the Ensley furnaces and about 350 feet distant from the stockhouse. This arrangement permits the most convenient delivery of the coke to the stockhouse. By a wire rope and winding engine the quenching cars are drawn up a grade of one to six into the stockhouse to an elevation sufficient to permit the coke to be dumped into a large bin with a sloping bottom, which in turn discharges directly into the furnace buggies that are sent to the tunnel head. Thus the coke is moved but three times after it is quenched until it lies in the furnace and the breakage is reduced to a minimum. A coke fork becomes a useless utensil, with a corresponding reduction of labor.

Turning now to the by-products from the coking plant, the by-product building is located midway between the two blocks of ovens, and is of slow burning mill construction. Two sets of gas condensers, one for each 30 ovens, are at each end of the building, and beyond them at one end is the sulphate of ammonia house. Within the building are the necessary exhausters, washers, pumps, tanks, etc,, for collecting the by-products. Immediately adjoining the property on the west is a tar distilling plant, and the tar collected from the gas, after being measured, is pumped directly from the by-product building to its receiving tanks. This plant produces from the tar roofing pitch, tar paper and creosoting oils, for all of which products there is a market in the South.

The ammonia produced is at present manufactured into sulphate of ammonia. As the ammonia is condensed out of the gas it is collected in the form of a weak liquor containing probably not more than 1 per cent. of ammonia, along with a good many impurities. To make the sulphate this liquor is distilled with steam, and the resulting ammonia gas is absorbed in a bath of sulphuric acid contained in a lead-lined tank. The crystals of sulphate fall to the bottom, whence they are raked out, drained and bagged for shipment.

The sulphate of ammonia finds a ready market, as there are large fertilizer factories in a large number of the Southern States, and sulphate is one of the most valuable sources of nitrogen obtainable. It is worth more per unit of nitrogen than nitrate, blood, or any of the other usual sources of this important element. Anhydrous ammonia—that is, ammonia gas condensed by compression into the liquid form—is used in large quantities throughout the South in the manufacture of artificial ice. This form of ammonia is not produced in the Ensley plant as yet, but it may be arranged for later.

The surplus gas from the plant, of which there will be some 2,000,000 cubic feet or more per day, is to be used in the new basic open hearth steel mill that is being erected within a short distance of the oven plant. This gas will doubtless prove to be of more value as an auxiliary than as a direct substitute for producer gas in the open hearth furnaces. It will be a great convenience for drying ladles, heating soaking pits, or in other places where comparatively small quantities of gas are required, and of a better quality than ordinary producer gas. It has been suggested that the open hearth furnaces be piped for the coke oven gas, in order to provide an easy means for rapidly controlling the heats if the occasion should arise.

While the oven plant is not yet in full run, enough work has been done to make a reliable comparison between the production of coke from this plant and from the beehive ovens of the Birmingham district. It is the practice of some of these plants to coke two 48 hour charges and one 72 hour charge per oven per week. At other places it is more common to run one 72 and one 96-hour charge per week. A comparison of the output of the bye-product ovens and the beehive shows that the 120 ovens in the bye-product will equal in production about 300 beehives making 48 and 72-hour coke and about 340 beehives running on 72 and 96 hour charges. The charges of coal are heavier when the beehives make only two charges per week. This difference in the output per oven of the beehive and retort oven plants is due to the more rapid coking in the retort oven, although the individual charges are smaller, and also to the increased yield in coke per ton of coal due to the improved method of coking. Careful tests have shown that this increased yield adds from one-sixth to one-fifth to the amount of coke produced from a ton of Pratt coal.

A careful estimate of the labor on a beehive plant of 300 ovens, compared with that on the plant of 120 bye-product ovens as operated at Ensley, shows that the beehive plant requires 1,020 hours labor per day, and the bye-product plant 732 hours. In the former figure are included only the men required to charge, level, water and draw the ovens and to load the coke on to cars. In the latter are included all men required about the plant, except the foreman, including those on the ovens and in the bye-product plant, delivering the coke into the furnace stockhouse, loading the sulphate of ammonia into the cars and delivering the tar to the purchaser. The delivery of the coke is a question of location. If the ovens were not at the furnace plant the coke would be delivered into railroad cars.

Modern Transformers.

Mr. G. W. Rhodes, writing in the *Electrical Review* (London, England), says that one of the most important considerations in the construction and organization of an alternating current installation is the choice of suitable transformers. Upon such a choice depends to a great extent the efficiency of the whole plant and the regulation of pressure on the consumers' premises. If the light load losses in a transformer are not kept as low as possible, the all-day efficiency is seriously affected; if the secondary resistance is too high, and if there is appreciable magnetic leakage, the regulation may be so bad as to breed dissatisfaction amongst the consumers and consequent loss of custom. On this account it is not only advisable to have transformers possessing all the most modern improvements, but also to employ as few as possible consistent with the requirements of the area to be fed. It is, in fact, economical to replace large numbers of old-type transformers by a few modern transformers having the same or greater aggregate capacity. This is well illustrated by the following cases:

In a town in Massachusetts having a population of 56,000, an alternating current station was constructed a few years ago, and 57 small transformers, having a total light capacity of 1,499 lights, were installed. Quite recently these have been replaced by 18 modern transformers capable of supplying 1,624 lights. The total core loss of the old transformers was 5,866 watts; that of the new, only 1,348. This difference in losses gives a yearly saving of 39,578 kilowatt hours, which may be valued at about £132. Thus neglecting all the advantages except the diminution of core losses, the cost of the change will be met in one year and nine months. The light capacity of the plant is increased 9 per cent., while the total core loss is decreased by 77.5 per cent. Further, on account of the decreased core loss, 4,518 additional watts are available for sale, producing an additional income of £169 at the present rate.

In another case 40 new-type transformers replaced 53 old ones. The total capacity of the old ones was 1,135 lights, of the new, 1,070. The core loss of the old transformers was 4,845 watts, and of the new, 1,343 watts. This gives an annual saving of 30,678 kilowatt hours, which will cover the expense of the change in two years and nine months.

As regards regulation, we cannot too strongly urge the necessity of keeping it under full control. It is not necessary to point out how injurious to incandescent lamps is undue variation of voltage. If lamps are over-run, their life is considerably shortened, and frequent renewals are the inevitable consequence. This, together with the bad light which results, is bound to beget the distrust and disgust of the consumer. It is a fact frequently not realized that a change of 1 per cent. in the voltage causes a change of 7 per cent. in the candle power of an incandescent lamp. A variation of 4 per cent. on either side of the normal voltage, that is a total variation of 8 per cent., means over 50 per cent. change in the candle power. It is a lamentable fact that such changes are only too frequent in alternating current plants, and it is more than probable that this is the chief reason why so many alternating current stations fail to produce a dividend.

Why should this bad regulation occur? It is not because alternating currents are not as capable as direct currents of feeding any given area. It is because the management of alternating currents is not sufficiently well understood, and their application is not manipulated with sufficient skill. The phenomena of alternating currents are much more difficult to understand than those of direct currents, and no one is competent to undertake the management of an alternating supply station whose acquaintance with the subject is entirely of a practical nature.

I do not wish to depreciate practical experience—far from it; but I do wish to emphasize the necessity of sound theoretical training as well. A manager of an alternating supply station ought to understand thoroughly the cause of the bad regulation and to fully appreciate the various remedies. Bad regulation may be due to poor transformers, to large wattless currents caused by motors, etc., and to various other causes. Each cause has its remedy, and if the proper one is applied good regulation will result. Theoretical training enables us to determine the causes and their remedies; practical experience tells how best to apply the remedy. I may safely say that the question of regulation is the most important of all to the supply company. What is more aggravating and annoying to the consumer than to have his 8-candle power lamps sometimes giving fully 12-candle power, and at other times barely 3 or 4-candle power—sometimes less than this? Yet such is the case with many alternating current stations. The result is, the consumers return to gas as being more reliable, the electric company loses its custom, or at any rate does not increase it. The electric supply committee grumbles because the plant does not pay, and the blame is laid on the alternating current. This is nonsense, sheer nonsense. The alternating current is all right if it is properly managed. It is the application and management which are at fault. The real reason why direct current stations are usually a greater financial success than alternating current stations is because the application and management are simpler and the regulation is more reliable. Make the regulation of an alternating plant equally good and the financial success will be greater, because often the losses in a direct current supply are greater than in an alternating current one. If potential wires are led from the centers of distribution to the generating station to give indications of the rise or fall of pressure, a competent man should be able to make an alternating current plant quite as reliable as is possible with continuous currents. Frequently it is an impossility to attain the necessary high efficiency with continuous currents, and, having installed an alternating current plant, it is an admission of incompetency to allow it to be a failure.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. William H. Durell, who had for many years been employed by the old Boston (Mass.) Gas Company, died at his home in Oakdale, Mass., the evening of October 27th. Deceased was born in Charlestown, Mass., January 5, 1823.

The result of the reduction in gas rates at Leavenworth, Kansas, has been such that Manager Palmer of the Leavenworth Light and Heating Company, had more than enough to keep him out of the ways of idleness all summer. Considerable main extension was completed, and the weak spots in the manufacturing plant were strengthened. The outcome of the new rates ($1 for fuel use and $1.25 on illuminating account) may best be shown in the statement that 275 gas ranges were in use there October 5th, and that the meters measuring gas on illuminating account exceed those in similar duty 18 months ago by 55 per cent. Manager Palmer seems not to be satisfied with the profit that followed his busy days this season, but proposes to keep along on similar lines, having mapped out greater things for 1899.

Mr. Robert Wilder Bush, the capable Superintendent of the Metropolitan branch of the Brooklyn Union Gas Company, no longer has to face the harsh world alone. The ceremony which freed him from singleness occurred at noon, of the 29th of October, in St. James' Church, Philadelphia. His wife (nee Caroline Clara Cooke) is the daughter of Mr. and Mrs. Jay Cooke, Jr. May they ever happy be.

The Riter-Conley Manufacturing Company, of Allegheny, Pa., has received the contract from the New England Gas and Coke Company, for the steel frame building for the purifying house of the latter's new plant at Everett, Mass. The ground plan of the building is 100 feet span by 270 feet in length with center row of columns, providing support for two 25-ton traveling cranes for the speedy and safe handling of the purifier covers. The height of the building is 35 feet to the bottom chord of roof truss, and an exceptionally large ventilator extends the full length of the building ensuring ample ventilation and light. The structure throughout, including the necessary supports for boxes, arrangement for conveyors, etc., is to be of steel and of the most substantial design.

The proprietors of the Logan Iron Works, Brooklyn, N. Y., have just closed a contract for about 1¼ miles of 60-inch water pipe, to be laid on a large estate in Mexico. The contract is to be completed by the end of February, 1899, and will require the use of several hundred tons of material.

A correspondent, writing under date of the 2d inst., says: "I read your brief note in the Journal of last week respecting changes in the Joplin (Mo.) lighting situation, and send you the following matter respecting the affair. The reorganization of the old Company was effected in St. Louis, on October 18th. The name of the succeeding corporation is that of the Joplin Illuminating Company and it is capitalized in $50,000. The principal shareholders are: Harrison I. Drummond (the wealthy tobacco manufacturer of St. Louis), John C. Porter, Jno. J. Dunham, Francis Kuhn and Chas. Nelson. Their interest was acquired through purchase at a special master in chancery sale. It is not at all improbable that Mr. H. A. Malin, who had acted as receiver of the property for some time prior to the sale, will be continued in its active management."

"OBSERVER" forwards the following: "The Winnisimet Gas Company, which proposes to supply gas in the Revere and surrounding districts of Massachusetts, promises to become a going concern. Its officers are: Directors, S. F. Bickford, Paul M. Richards, Frank H. Dow, Artemas B. Wayman, Geo. N. French, Ernest H. Pierce, Nathan F. Carruth, Rollin T. Lincoln, Sam. H. Hix and C. W. Grose; President, S. F. Bickford; Vice President, R. T. Lincoln; Treasurer, Paul M. Richards; Clerk, Frank H. Dow.

MR FRED. WINSLOW, City Treasurer, of Kalamazoo, Mich., under date of October 24th, caused the following notice to be published prominently to the residents of Kalamazoo: "Notice is hereby given that the undersigned will offer for sale, to the highest bidder for cash, at 2 o'clock, P.M., Oct. 31, the following goods, chattels and property of the Kalamazoo Gas and Electric Company for the purpose of raising a sufficient sum of money to pay the tax due from said Company to the City of Kalamazoo upon an assessment made according to law, in May, 1898, upon real and personal property of said Company, of which the goods hereby offered for sale are a part."

THEN follows a list of the articles levied upon, which list starts with "a quantity of coal," and ends with "one letter press." So much for the up to-date development of the Hall process in Kalamazoo.

WE are in receipt of a communication, to hand Tuesday the 4th inst., bearing the signature "Mac Duff," and postmarked New York city. With the matter outlined in the letter we are in thorough accord and would like to publish the same, but the fact is that, as it stands just now, the communication is anonymous, a condition which prevents its publication. If "MacDuff" will forward his name and address to us, which name and address are meant merely for our own protection and not for revealment to anyone else, we will be pleased to "lay on" his speech for the edification of our readers.

THE Berlin Iron Bridge Company, of East Berlin, Conn., is erecting for the United Gas Improvement Company, at the latter's works in Waterbury, Conn., the steel work for a generator room and engine room. The generator room is to have a span of about 51 feet, and the span of the engine room is to be about 33 feet. The roofs are to have steel trusses supporting the roof covering, which is to be of corrugated iron faced with the Bridge Company's patent, anti-condensation fireproof lining.

MR. C. P. GILBERT has resigned the position of General Manager to the Sacramento (Cal.) Electric, Gas and Railway Company. Mr. Albert Gallatin, the Vice-President of the Company, will assume the duties performed by Mr. Gilbert.

THE Pontiac (Ills.) *Leader* of recent date had this to say anent the proposition to operate a gas works there—mention of the incorporation of the Company has been made in the JOURNAL: "Things seem to be shaping in such a way as to insure for Pontiac another illuminating medium. The city is now lighted by electricity supplied by a private Company; but Pontiac is extending and increasing its property and population, and it demands all the approved accessories of modern city life, and among these is another illuminating medium. In fact, there is an urgent call for a gas lighting supply in this city. Nearly all progressive towns have both electricity and gas for public and private use, and it seems that Pontiac is soon to enjoy both. Dr. Joel Allen and B. F. Jones, of Pontiac, and Mr. Isaac Eastman, of Monmouth, Ills, have organized a Company for the purpose of establishing a plant for the manufacture of gas in the city. The capital stock is placed at $40,000, and may be increased. Mr. Eastman, who is an experienced man in the business, and who has superintended the Monmouth gas works for a long time, will move here and take personal supervision of the operations. It is not stated what process will be adopted in the manufacture of gas here, but it is likely the water system will be employed. The site of the works has not been selected, but those interested say it will be north of the river—the Vermilion. First class buildings will be erected and the plant will come fully up to modern requirements. It is promised that work will be commenced in the spring as soon as the weather will permit, and that by August of next year the plant will be in operation and ready to serve Pontiac people with gas. It is the purpose of the promoters to supply gas at a figure not to exceed $1.50 per 1,000 cubic."

WE regret to report the death of Mr. Hobert L. Gerould, brother of Mr. C. L. Gerould, Superintendent of the American Gas Company's plant in Mount Vernon, N. Y. Deceased passed over at his home, in Northampton, Mass., on the afternoon of Friday, Oct. 28. He was in his 32d year. The funeral services were held in Northampton on October 30th.

WE understand that the Consolidated Gas Company, of this city, has sold to the United States the property owned by it at Shadyside, on the north shore line of the Hudson river. The government, it is said, proposes to establish there a naval storehouse.

MESSRS. BARTLETT, Hayward & Co., of Baltimore, Md., are to build the new storage holder for the Excelsior Coke and Gas Company, of Topeka, Kas. The holder is rated to a capacity of 250,000 cubic feet. This is but the preliminary to important plant betterments and main extensions.

INFORMATION from Little Rock, Ark., is to the effect that the Pulaski Gas Light Company of that city has been acquired by Eastern capitalists, headed by the Mayor of Boston, Mass., and Mr. H. Allen Odell, whom the Little Rock *Gazette* declares "Is a distinguished member of the New York bar." The new proprietors have perfected the following organization: Directors, Josiah Quincy, of Boston; H. A. Odell, of New York; Durand Whipple, of Little Rock, and Messrs. John G. Fletcher, Chas. F. Renzel, Oscar Davis, S. M. Apperson and H. W. Bates; President, H. A. Odell; Treasurer, Josiah Quincy; Secretary, Durand Whipple. It is said the owners will make many changes for the good of the plant, and it is also understood that Superintendent D'Alemberte will be retained in the active management of the works.

IT is reported in the Washington (D. C.) newspapers that Mr. John C. Bullitt, of Philadelphia, and Mr. L. Z. Leiter, of Chicago, have acquired large holdings in the capital of the Washington Gas Light Company.

WE have it on authority resident in Milwaukee, Wis., that Mr. A. M. Sutherland, of New York, has joined hands with Messrs. William and Sinclair Mainland in securing complete ownership of the Green Bay (Wis.) Gas and Electric Light Company.

A HINT from Butte City, Montana, is to the effect that the Butte Gas Light and Coke Company is enjoying a brisk trade. Welsbach lamps seem to have captured the light using community of Butte, for the Company is up to the limit of an increased working force in completing the placing of burners on Welsbach account. The Company did not mean to add to its generating capacity this year, but the demands on the plant were such that it is now hurrying to completion a bench of 6's, a rush order for which was placed with the Laclede Firebrick Manufacturing Company, of St. Louis. Manager and Secretary Feurtado evidently means to keep up with the lighting needs of the mining city.

SUPERINTENDENT J. W. MURDOCK, of the Ottawa (Ills.) Company, has managed to make its office one of the show places of the city during the evening times. The magnet is an arch and a ring of illumination, directly in front of the Company's offices at Madison and Court streets. The ring, which is about 3 feet in diameter, faces Madison street, and the arch, which fronts on Court street, carries the name of the Company. The illuminating effect is produced by the use of a sufficient number of small gas jets properly encased.

FINAL action on the proposed gas franchise, to permit consolidation of the two Memphis (Tenn.) Gas Companies, has been postponed to the end of this month. Mayor Williams favors the measure as an equitable one for the Companies and as a just one to the residents, but certain wiseacres in the employment of the city as counsel, attorneys, etc., have seemingly sufficient influence with the Council to cause the latter to procrastinate. Our old friend procrastination may be the thief of time, but our old friend certainly is an ally of the legal fraternity.

THE Milwaukee (Wis.) Gas Company has purchased a site, having a frontage of 60 feet on Wisconsin street, just east of Jackson street, and a depth of 120 feet, on which it is proposed to erect a handsome office structure up to its trade requirements.

THE formal merging of the conflicting gas interests in Buffalo, N. Y., it is understood will be completed, at a special meeting to be held in New York to-day.

THE following, which is from the Boston *Journal*, of October 27th, explains itself:

"The Board of Gas and Electric Light Commissioners met yesterday for a public hearing on the act of the present year providing for a re-

port by the Board on a plan of consolidation of the Boston gas interests. The attendance was not large. Among those present were Henry M. Whitney, George Albree, John H. Carter, Treasurer Barnes of the Cambridge Gas Light Company, W. M. Butler, E. A. McLaughlin, George B. Neal of the Charlestown Gas Company, John Thompson of the East Boston Company and others. Chairman Barker called for the names of those that desired to be heard. Mr. Neal said he thought the consolidation might be a good thing, but his Company did not ask it. President Thompson said that the East Boston Company did not favor the plan, but he came to listen. William M. Butler, representing the Brookline, Jamaica Plain and Dorchester Companies, said that he did not desire to be heard at this time, as it had been impossible to get the stockholders together. Later he might have some suggestions to offer. Harrison H. Schaff stated that he represented holders of stock in the Bay State Gas Company, of Delaware, and United Gas bonds. As this was a minority interest he did not feel that he should be heard first. The Chairman asked if any person was present representing the Boston, Roxbury, South Boston, Massachusetts Pipe Line Gas Company, or the New England Gas and Coke Company. There was no response. Commissioner Gifford of the Board said that it was evident the hearing was a failure, and he moved that it be closed. This would not prevent any persons appearing at any time to make suggestions or offer assistance. It was the clear duty of the Board to go ahead with the work assigned by the Legislature. Chairman Barker expressed the disappointment of the Board that no one was present to speak. Counsel Schaff objected to closing the hearing. He hoped that Mr. Butler would make his suggestions in a public hearing, where he could be answered. Mr. Gifford withdrew his motion. Chairman Barker said the hearing would be adjourned to November 2d at 10 o'clock. To this counsel agreed, though Mr. Butler could not promise he would have any suggestions to make at that time."

Working in Compressed Air.

Engineering "notes" that in a paper contributed to the recent International Congress of Internal Navigation, the precautions necessary to avoid serious injury to workmen laboring under compressed air were considered by Messrs. Heller, Mager and Von Schrötter, three Austrian doctors of medicine. Amongst the conclusions arrived at is one to the effect that the limit of pressure at which the men should be asked to work is 5 atmospheres, corresponding to an hydraulic head of 170 feet. The workmen employed should not be less than 20 years of age nor more than 50, and should only be engaged after a rigorous medical examination has proved the soundness of their hearts, lungs and vascular systems. Men having anything wrong with their ears should only be accepted after a special examination. Whilst at work the men should, it is claimed, be under medical supervision and control, and should never be allowed to work if suffering from a cold in the head or a gastric attack. If suffering from caisson disease, they may be allowed to resume work after cure. The time of getting under pressure in the air lock should generally be one minute for every tenth of an atmosphere of pressure, but in the case of men accustomed to the work, this limit may be somewhat reduced to, say, a total of 15 minutes for a pressure of 2½ atmospheres, and 30 minutes for a pressure of 5 atmospheres. It is not necessary to fix any limit to the time a workman stays under pressure, but on release the pressure should be reduced, not more rapidly than one-tenth of an atmosphere in two minutes, so that with men working at a depth of 170 feet, under water, 100 minutes would be needed to pass through the air lock on leaving the caisson. During the lockage the atmosphere inside should be continually renewed, and when this is done the dimensions of the lock may be made as little as 25½ cubic feet per man, so that four men might be passed together through a lock of 102 cubic feet capacity. To prevent chills the men, when at work or in the lock, should wear thick woolen clothing. Electric lighting should be used exclusively both for the working chamber and the locks. The men should be compelled to reside near the works, and in cases in which the pressure exceeds 1½ atmospheres, they should be housed in barracks, which should be fitted up with a pressure chamber containing a bed, telephone and other conveniences, in which men suffering from the effects of the pressure may recover. As to the ventilation of the working chamber, the air there should be renewed at the rate of 730 cubic feet per head per hour. The men should be advised to swallow the saliva repeatedly whilst the pressure is being changed, and the flow of the same may be assisted by a morsel of sugar. Strong expirations compressing the air against the tympanum, with the mouth and nostrils closed, are particularly useful.

Machine-Mined Bituminous Coal.

Mr. E. W. Parker, in his report to the U. S. Geological Survey, respecting the coal production of 1897, had this to say about machine-mined bituminous coal:

The reports show that mining machines were in use in 20 States in 1897, as compared with 16 in 1896, and 8 in 1891. Utah and Washington, which had a machine-mined tonnage of 760 and 3,920, respectively, in 1896, did not report any product so won in 1897; 6 States which did not report any coal won by machines in 1891 or 1896 had a combined machine-mined product of nearly 2,000,000 short tons in 1897. These States were Alabama, 294,384 short tons; Kansas, 4,500 short tons; Kentucky, 1,299,436 short tons; Tennessee, 47,207 short tons; Texas, 11,750 short tons; and Virginia, 323,649 short tons.

The number of firms using machines has increased from 51 in 1891 to 136 in 1896 and 211 in 1897. The number of machines in use has increased from 545 in 1891 to 1,446 in 1896 and 1,988 in 1897. The amount of coal won by machines has increased from 6,211,732 short tons in 1891 to 16,424,932 in 1896 and 22,649,220 short tons in 1897. The most significant increase shown by these statistics, however, is in the percentage of machine-mined coal to the total product. In 1891 the proportion of the total product won by machines was 5.49 per cent., in 1896 12.41 per cent., and in 1897 15.95 per cent. These increases are rendered all the more significant when the total tonnage in the States included in this tabulation is considered in comparison with the machine-mined product. The total product of the 22 States included in the following table in 1891 was 113,199,882 short tons; in 1897 the product of the same States was 141,993,577 short tons; showing an increase of 28,793,695 short tons, or 25 per cent. The product won by machines has increased from 6,211,732 short tons to 22,649,220 short tons, a gain of 16,437,488 short tons, or 265 per cent. The total bituminous product of the United States from 1891 to 1897 increased 25 per cent., or 29,888,665 short tons, of which 16,437,488 short tons, or 14 per cent., was represented by the increase in machine-mined coal.

With the exception of Utah and Washington, every State had a larger product from machines in 1897 than in 1896, and in only two other cases, Indiana and Missouri, was the ratio of machine product to the total less in 1897 than in 1896.

Practically all the coal mined in Alaska is extracted by machines, giving that territory a percentage of 100. Montana's machine mined coal was 43.77 per cent. of the total in 1897, against 37.54 per cent. in 1896. Of Kentucky's product in 1897, 36.07 per cent. was mined by machines. These two States represent the most important development in machine mining as compared to the total production. Pennsylvania, the largest producer, has also the largest machine tonnage, but the latter was only 12.29 per cent. of the total product of the State in 1896, and 16.35 in 1897. Illinois comes second, both in total output and machine product, the latter being a little over 19½ per cent. of the total output of the State in each year. Ohio, fourth in production, is third in the amount of coal mined by machines, her machine-won product in 1897 being within 3 per cent. of that of Illinois. West Virginia, the third State in amount of production, has a comparatively unimportant machine product. Kentucky ranks eighth in amount of product and fourth in machine tonnage; Indiana ranks seventh and fifth, respectively; Montana, fourteenth and sixth; and Wyoming, thirteenth and seventh. These are the only States whose production by the use of machines exceeded 500,000 short tons in 1897.

The remarkable increase in the production of coal by the use of machines, superseding a large amount of manual labor and cheapening the cost of production, has undoubtedly had an important bearing on the prices of bituminous coal, which have declined steadily for several years. In some cases selling prices have been lowered on account of the lessened cost of production; in other cases machines have been introduced in order to meet reduced prices caused by an already glutted market. In nearly all cases the benefit that might have been derived from the introduction of machines has been sacrificed in the effort to increase tonnage rather than to continue previous output with a shortened pay roll.

The Market for Gas Securities.

Whatever change occurred in the market for city gas shares during the week was for the better, the high rate for Consolidated having been 188¾, on a comparatively limited scale of trading. The price for it today (Friday) is 187 to 189, with very little doing. Amsterdams are, strange-to-say, very much on the improving list, but there is good reason for the advance in Standards. Mutual, too, shows improvement.

Brooklyn Union is still reflecting its value in the price being paid for it. Its next dividend (3 per cent.) is to be paid December 1st. The feature of the market, though, was the advance in Jersey City gas shares, notably Peoples, which is 240 bid. Mr. Perot's pertinacity stands him in good stead. Consumers, of Jersey City, is worth noticing. The "feature," however, of the market is B. S.; to-day it sold at 4¼. It may be that the long expected turn has come at last. The proceedings, or rather the lack of proceedings, in the first hearing before the Board of Gas and Electric Light Commissioners, is "omenous." The general list is strong.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

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MANAGER.

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MONDAY, NOV. 7, 1898.

Gas Stocks.

Quotations by Frederic B. Cochran & Co., Brokers and Dealers in Gas Stocks.
20 AND 22 BROAD STREET, NEW YORK CITY.

Nov. 7.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$37,730,000	100	187	189
Cental Union, Bonds, 5's	3,000,000	1,000	101	101½
Equitable Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	.	108	112
Mutual	3,500,000	100	305	320
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co.	13,000,000	100	29	30
Preferred	10,000,000	100	68½	69½
Bonds, 5's	11,000,000	1,000	101¼	102
Northern Union, Bonds, 5's	1,250,000	1,000	94½	95½
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	111	113
" 1st Con. 5's	1,500,000		107½	108½
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000		
Standard	5,000,000	100	130	135
Preferred	5,000,000	100	148	158
Bonds, 1st Mortgage, 5's	1,500,000	1,000	112	114
Yonkers	299,65	500	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	127½	128
" " Bonds (5's)	15 000,000	1,000	115	115½
Bay State	50,000,000	50	8½	8¾
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works..	450,000	100	..	..
" 1st Mtg. 5's	450,000	1,000	..	..
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	92	..
2d " " "	3,000,000	1,000	..	80
Buffalo City Gas Co.	5,500,000	100	20½	21
" " Bonds, 5's	5,250,000	1,000	93	93½
Central, San Francisco	2,000,000	..	105	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,144,700	100	89	91
1st Mortgage	1,207,000	1,000	101	103½
Consumers, Jersey City	2,000,000	100	80	..
" Bonds	600,000	1,000	102	104
Cincinnati G. & C. Co.	8,500,000	100	202½	203
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		
Consolidated, Baltimore	11,000,000	100	64¾	65
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000		.	..
Consolidated Gas Co. of N.J.	1,000,000	100	16	21
" Con. Mtg. 5's	380,000	1,000	75	80
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,560,000	50	65	65½
" Prior Lien 5's	4,546,000	1,000	94¼	94½
Detroit Gas Co., 5's	423,000	1,000	..	..
" Inc. 5's	31,000	100	..	..
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wa	2,000,000	..	75	80
" Bonds	2,000,000	..	88	
Grand Rapids Gas Lt. Co..	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	115	125
" Bonds, 6's	2 650,000	..	106	107
Jackson Gas Co	250,000	50	..	..
" 1st Mtg. 5's	250,000	1,000	..	..
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	78	83
Bonds	1,000,000	1,000	90	91
Louisville	2,570,000	50	..	..
Laclede, St. Louis	7,500,000	100	47¾	48
Preferred	2,500,000	100	92	94
Bonds	10,000,000	1,000	105½	106
Madison Gas & Elec. Co.	400,000	100	..	..
" 1st Mtg. 6's	350,000	1,000	..	..
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Gas Co.	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	128	130x
New Haven	1,000,000	25	252	..
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	53½	55
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	103½	103¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	.	108
2d "	2,500.000	1,000	104	105
Peoples, Jersey City	500,000	50	240	250
Rochester Gas & Elec. Co..	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000		87½	90
San Francisco, Cal.	10,000,000	100	88½	89
St. Paul Gas Light Co.	1,500,000	100	30	32
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1 000	..	..
General Mortgage, 5's	2,428,000	1,000	80	82
St. Joseph Gas Co.	1,000,000	100	..	..
" 1st Mtg. 5's	750,000	1,000	..	..
Syracuse, N. Y.	1,750,000	100	153¼	163¼
Bonds	1,612 000	1,000	85	80
Washington, D. C	2,000,000	20	250	..
First mortgage 6's	600,000			..
Western, Milwaukee	4,000,000	100	85½	86
Bonds, 5's	3,880,500	.	101¾	102½
Wilmington, Del.	550,000		204	206

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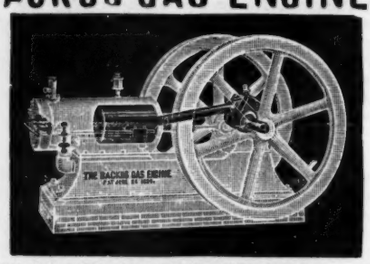

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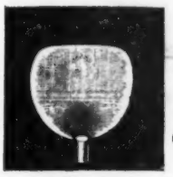

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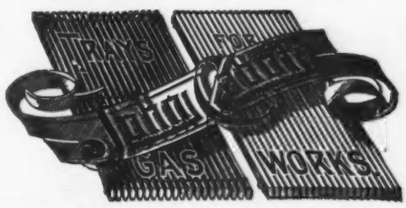

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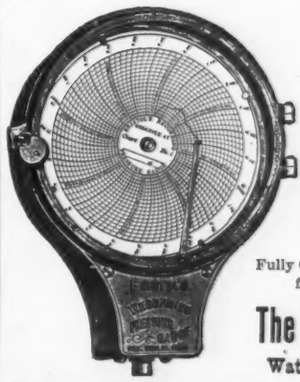

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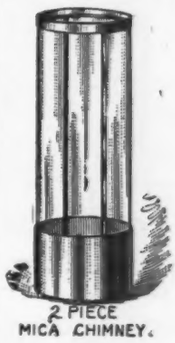

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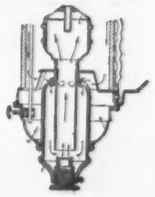

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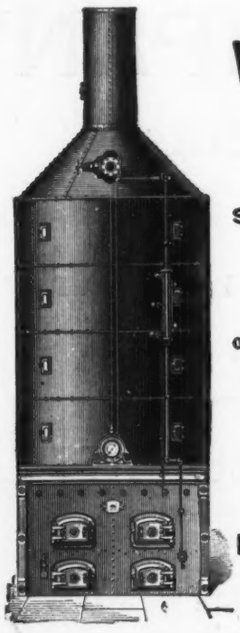

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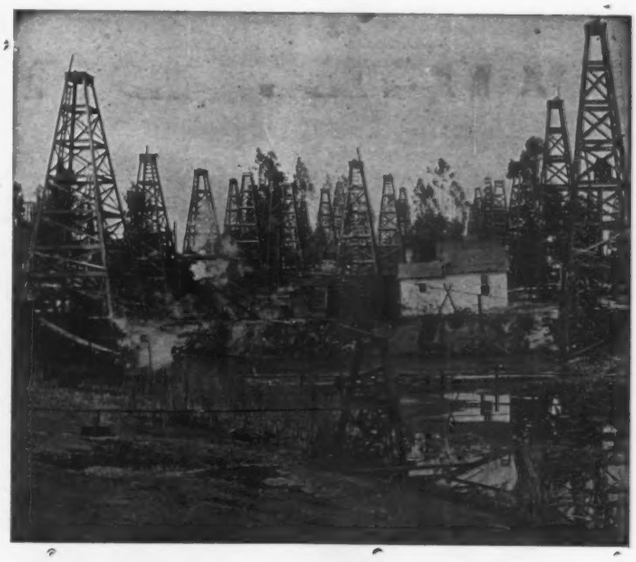

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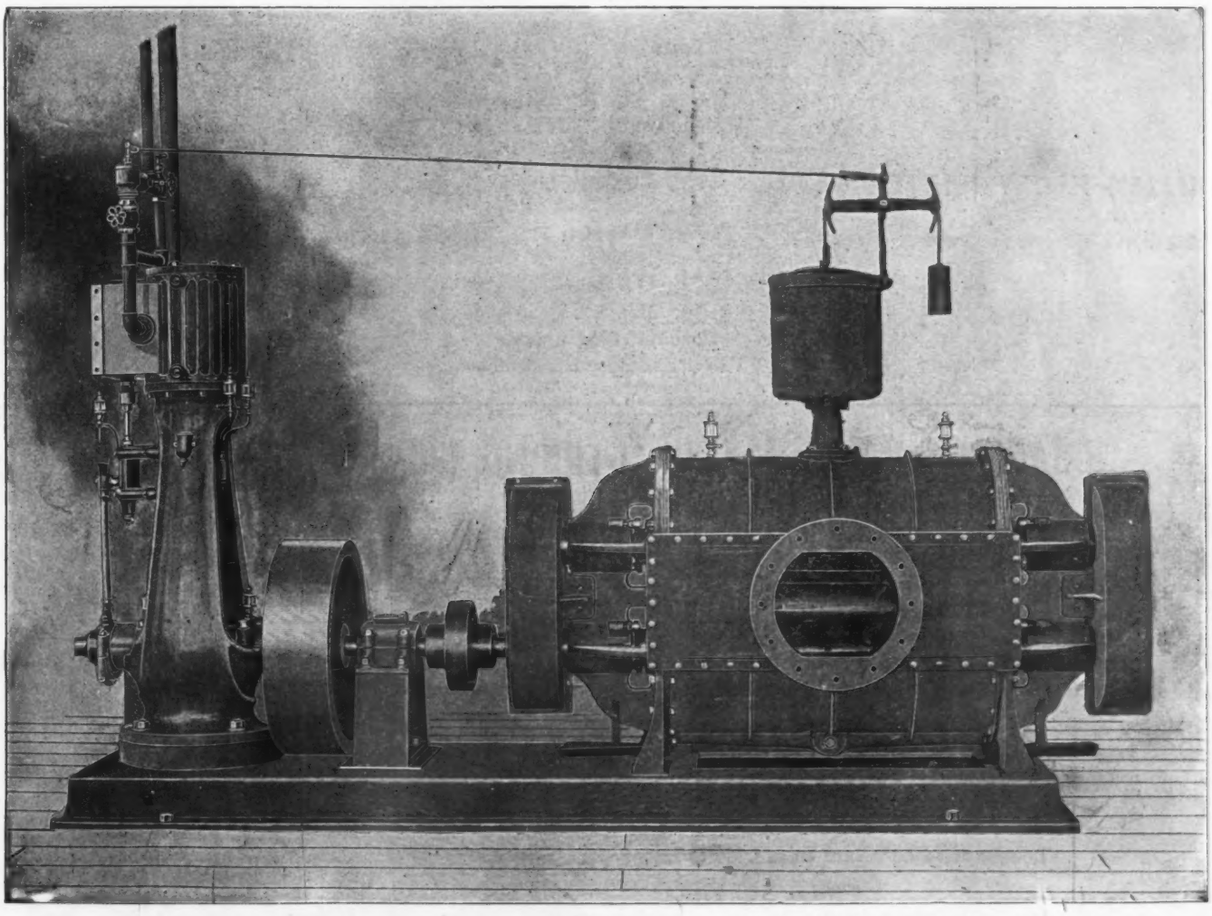

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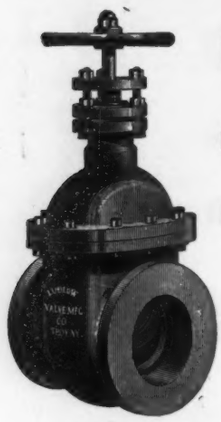

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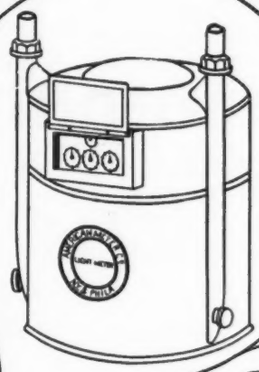
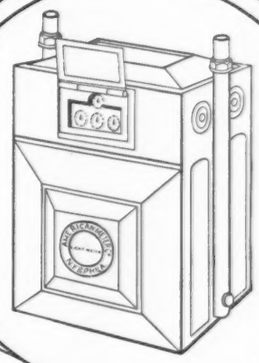
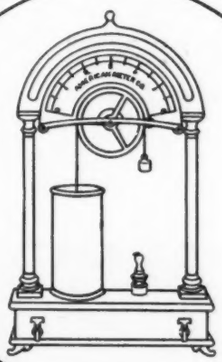


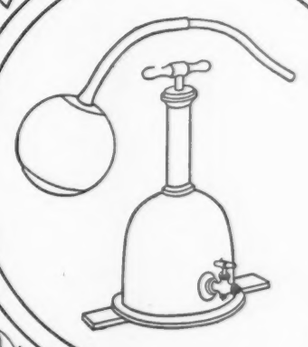


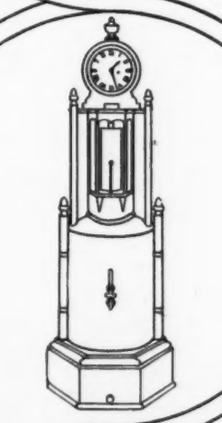


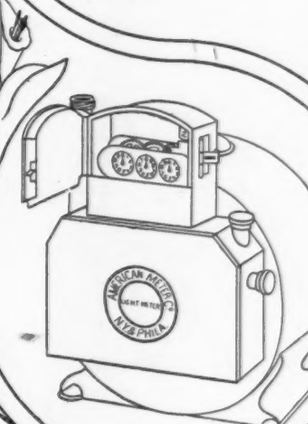
PUBLIC LIGHTING TABLE.

NOVEMBER, 1898.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Tue.	1	5.30 PM	8.00 PM	4.45	5.35
Wed.	2	5.30	8.50	4.45	5.35
Thu.	3	5.30	9.50	4.45	5.35
Fri.	4	5.30	10.50	4.45	5.35
Sat.	5	5.30	11.50	4.40	5 45
Sun.	6	5.20 LQ	12.50 AM	4.40	5.45
Mon.	7	5.20	1.50	4.40	5.45
Tue.	8	5.20	2.50	4.40	5.45
Wed.	9	5.20	3.50	4.40	5.45
Thu.	10	5.20	5.40	4.40	5.45
Fri.	11	5.20	5.40	4.40	5.45
Sat.	12	5.20	5.40	4.30	6.00
Sun.	13	5.10 NM	5.50	4.30	6.00
Mon.	14	5.10	5.50	4.30	6.00
Tue.	15	5.10	5.50	4.30	6.00
Wed.	16	5.10	5.50	4.30	6.00
Thu.	17	5.10	5.50	4.30	6.00
Fri.	18	8.40	5.50	4.30	6.00
Sat.	19	9.50	5.50	4.25	6.00
Sun.	20	11.00 FQ	6.00	4.25	6.00
Mon.	21	12.10 AM	6.00	4.25	6.00
Tue.	22	1.20	6.00	4.25	6.00
Wed.	23	2.20	6.00	4.25	6.00
Thu.	24	3.30	6.00	4.25	6.00
Fri.	25	4.30	6.00	4.25	6.00
Sat.	26	No L.	No L.	4.20	6.10
Sun.	27	No L. FM	No L.	4.20	6.10
Mon.	28	No L.	No L.	4.20	6.10
Tue.	29	5.10 PM	6.40 PM	4.20	6.10
Wed.	30	5.10	7.40	4.20	6.10







TOTAL HOURS LIGHTING DURING 1898.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	210.40	January	423.20
February	186.40	February	355.25
March	181.20	March	355.35
April	166.10	April	298.50
May	156.40	May	264.50
June	144.30	June	234.25
July	147.30	July	243.45
August	157.10	August	280.25
September	169.50	September	321.15
October	186.00	October	374.30
November	204.30	November	401.40
December	218.30	December	433.45
Total, yr.	2129.30	Total, yr.	3987.45

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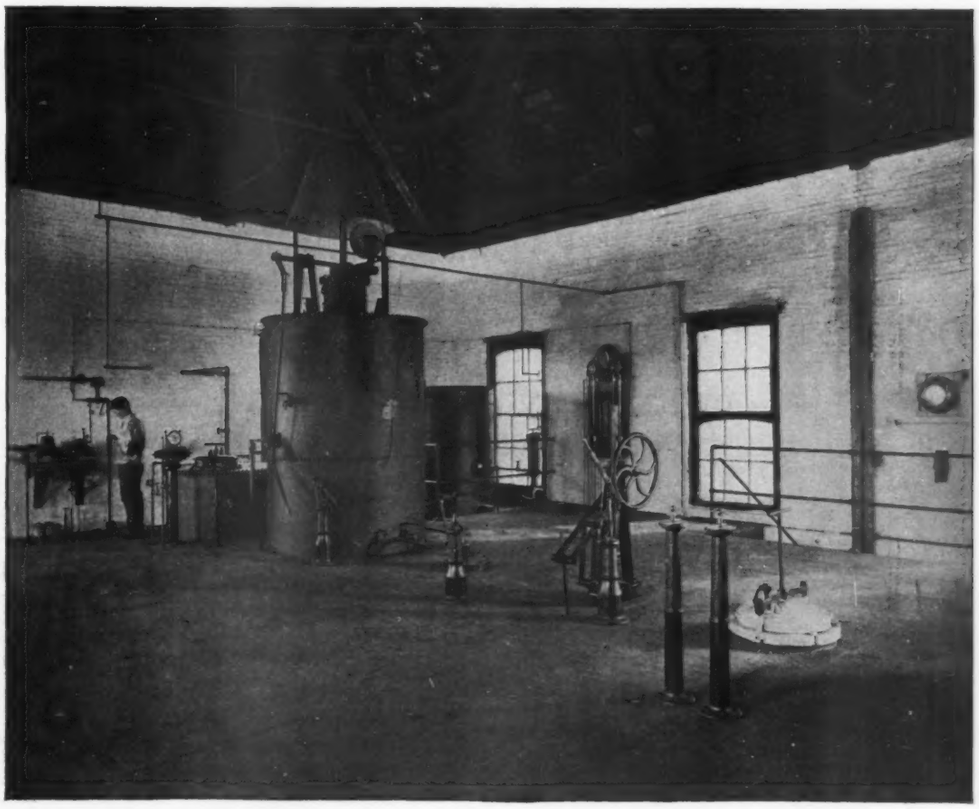

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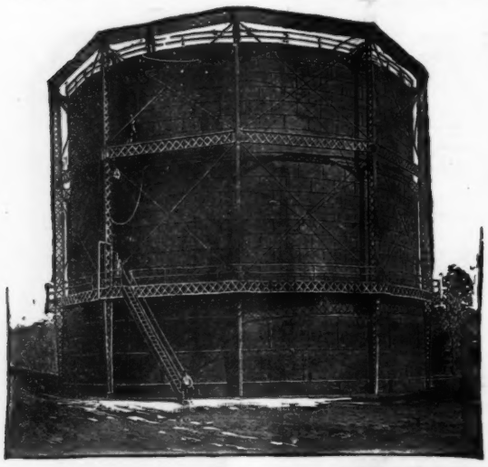

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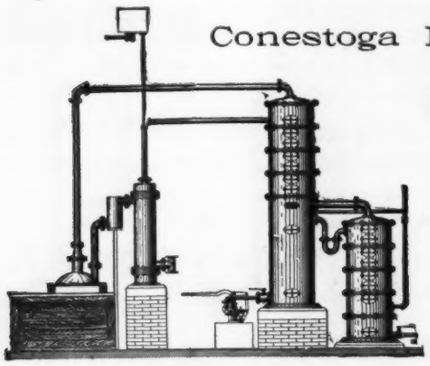

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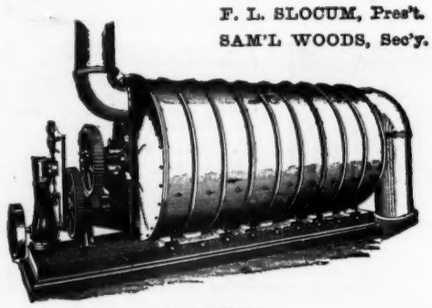

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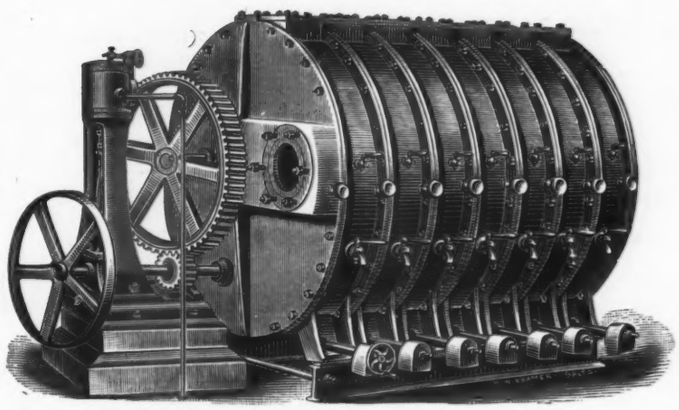

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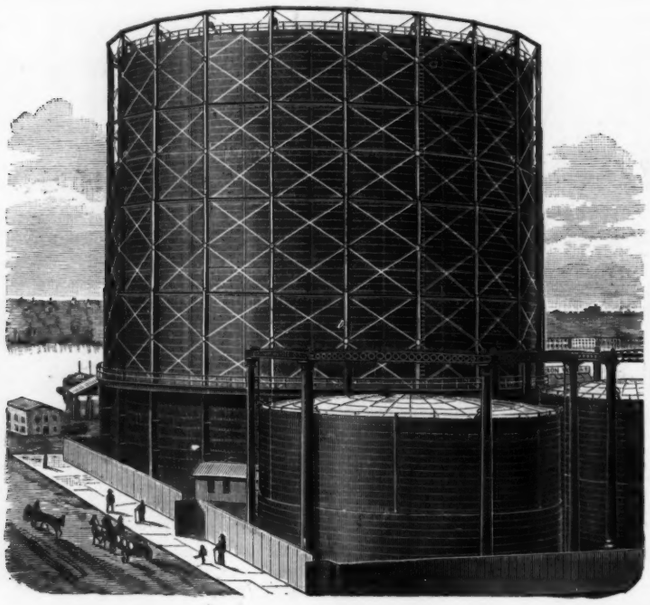

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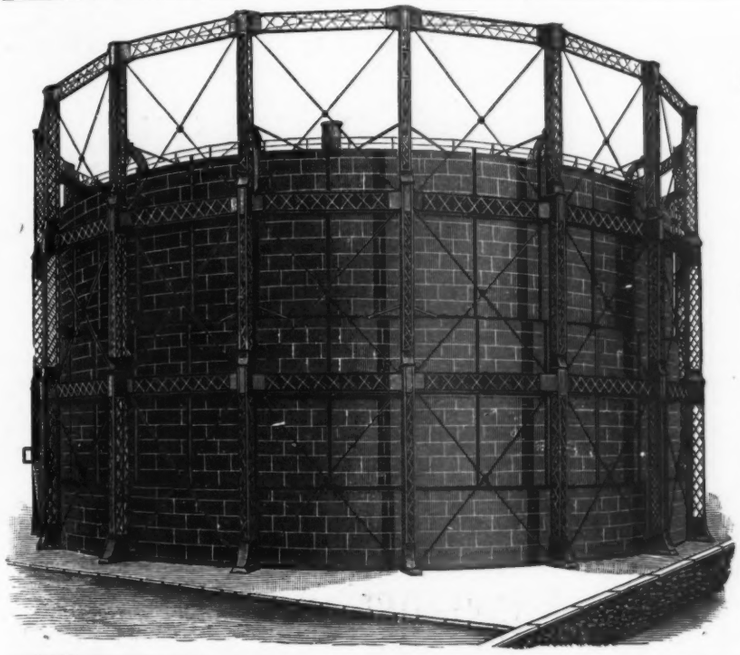

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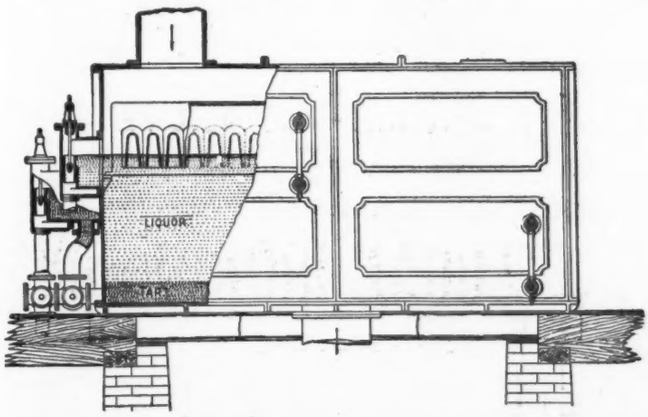

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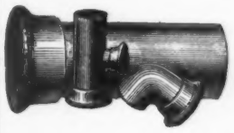

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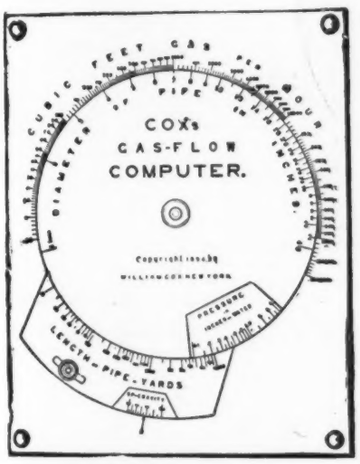

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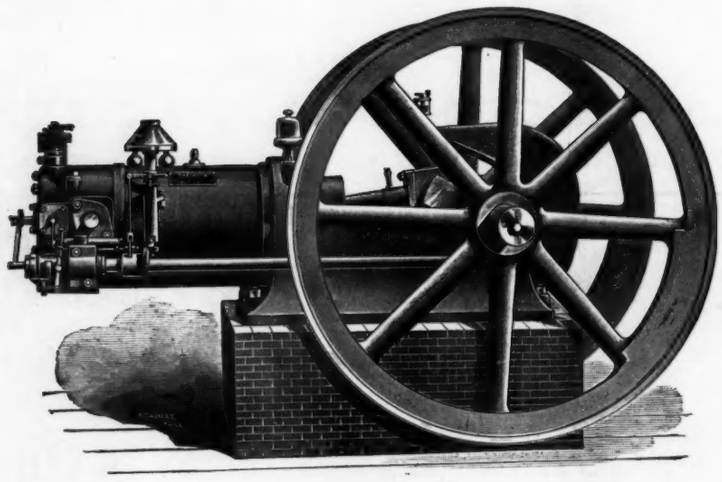

The United Gas Improvement Company, by the lease of the Philadelphia Gas Works, derives a yearly revenue estimated at **$250,000 to $275,000** from the sale of gas consumed by OTTO GAS ENGINES exclusively in the city of Philadelphia, there being over 700 engines in use, ranging from 1 to 50 H.P.

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